**University of Alberta**
**Department of Mathematical & Statistical Sciences**

# MATH 418 – Honors Real Variables II – Fall 2019

# MATH 516 – Linear Analysis – Fall 2019


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| **Instructor:** | Dr. Arno BERGER |
| **Office:** | CAB 683 |
| **E-mail:** | berger@ualberta.ca |
| **Office Hours:** | MWF 2:00 – 4:00 pm, or by appointment |
| **Lecture Room & Time:** | CAB 365, MWF 10:00 – 10:50 am |


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**Course Web Page:**

www.math.ualberta.ca/~aberger/courses/math418_19/math418_19.html

Please make a habit of visiting this site regularly.

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**Course Description:**
Classical Banach spaces. Hahn-Banach, open mapping and closed graphs theorems. Hilbert spaces, orthonormal bases. Elements of spectral theory, spectra of compact operators, spectral theorem for compact self-adjoint operators.

**Course Pre- and Corequisites:**
Prerequisite: MATH 417. Corequisite: MATH 447. The undergraduate version of this course (MATH 418) is primarily for Honors students in Mathematics or Physics.

**Required Textbook:**
No set textbook will be used, and you should be prepared to take careful notes in class. Course notes from a previous version of MATH 516 have kindly been provided by Dr. Runde and are available in electronic form on the course website; they are recommended for background reading.

**Grade Evaluation:**
The final letter grade is determined from the course mark as follows: For MATH 418 a total mark of 50% or more guarantees a passing grade of at least D, whereas for MATH 516 a total mark of 60% or more guarantees a passing grade of at least C+; for both versions of the course, a total course mark of 90% or more guarantees a grade of at least A−. Grades are unofficial until approved by the Department and/or Faculty offering the course. There is no possibility of a re-examination in this course.

| **Component** | **Weight MATH 418** | **Weight MATH 516** | **Date** |
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| Assignments | 20% | 15% | announced in class and on eClass |
| Midterm I | 20% | 15% | **23 October 2019**, in class |
| Midterm II | 20% | 15% | **27 November 2019**, in class |

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| Project | N/A | 15% | due **6 December 2019,** 4pm |
| Final Exam | 40% | 40% | **17 December 2019**, 2 pm |

**Note:** The date of the final examination is set by the Registrar and takes precedence over the final examination date reported in this document. Students must verify this date on BearTracks when the Final Exam Schedule is posted.

**Assignments:**
Up to five assignments will be posted on eClass, roughly fortnightly and at least one week prior to their respective due date. Unless announced otherwise in class and on the course website, assignments are due on **Wednesday,** at **4 pm**. Please deposit your assignment into the MATH 418/516 assignment box on the third floor in CAB. Please make sure all pages of your submission are stapled together and your name is clearly written on the front page. Collaboration on homework problems is acceptable. However, to receive credit you have to submit your own working. Your submission will be graded and returned to you as soon as possible. **Late submissions will not be accepted!**

**Project:**
MATH 516 students will have to complete one project on a specific topic of the course. All details will be provided in class as and when appropriate.

**Exam Format and Aids:**
All exams are closed-book and may have a multiple-choice component. The duration of each midterm is 50 minutes, and the final is a two-hour exam. Exam questions will be similar to problems considered in class and as part of homework assignments. No individual formula sheets, calculators and any other electronic aids are permitted during examinations.

**Representative Evaluative Material:**
You are encouraged to have a look at old MATH 418/516 exams (available from the Department of Mathematical & Statistical Sciences). Sample tests may also be made available prior to examinations.

**Further Reading:**
The following textbooks, mostly available at the University of Alberta or other local libraries, are good sources for further reading:

M. Haase, *Functional Analysis. An Elementary Introduction* (introductory),
B.D. MacCluer, *Elementary Functional Analysis* (introductory),
N. Young, *An introduction to Hilbert space* (introductory),
B. Bollobás, *Linear analysis: an introductory course* (advanced),
J.B. Conway, *A Course in Functional Analysis* (advanced),
W. Rudin, *Functional analysis* (advanced).

**IMPORTANT:**
**MATH 418/516 is a serious mathematics course. Do take it seriously: Take careful notes in class. Make a true effort on most homework problems, even if you cannot solve them completely. Regard asking questions as an important part of your learning experience – don't be shy to ask your fellow students or instructor.**

**Excused Absence Where the Cause is Religious Belief:**
For an excused absence where the cause is religious belief, a student must contact the instructor within two weeks of the start of Fall classes to request accommodation for the term (including the final exam). Instructors may request adequate documentation to substantiate the student request.

**Missed Midterms:**
If you cannot write a midterm due to incapacitating illness, severe domestic affliction or other compelling reasons you can apply for an excused absence. In order to do so, you must present supporting documentation pertaining to the absence to the instructor within two working days following the scheduled date of the missed midterm, or as soon as you are able, having regard to the circumstances underlying the absence. In all cases, instructors may request adequate documentation to substantiate the reason for the absence at their discretion. If the reason for your absence is deemed valid, the weight of a missed Midterm I will be transferred in equal parts to Midterm II and the Final Exam, whereas the weight of a missed Midterm II will be transferred to the Final Exam. There will be no deferred midterms.

**Note:** An excused absence is a privilege and not a right; there is no guarantee that an absence will be excused. Misrepresentation of Facts to gain an excused absence is a serious breach of the *Code of Student Behaviour*.

**Missed Final Examination:**
A student who cannot write the final examination due to incapacitating illness, severe domestic affliction or other compelling reasons can apply for a deferred final examination. Students who failed at the start of term to request exam accommodations for religious beliefs are expected to follow the normal deferred final examination process. Such an application must be made to the student's Faculty office within two working days of the missed examination and must be supported by a Statutory Declaration or other appropriate documentation (Calendar section 23.5.6). Deferred examinations are a privilege and not a right; there is no guarantee that a deferred examination will be granted. Misrepresentation of Facts to gain a deferred examination is a serious breach of the *Code of Student Behaviour*. Any deferred final examinations are scheduled for **11 January 2020** at **9 am** (register at **8:30 am** on the third floor of **CAB**).

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## STUDENT RESPONSIBILITIES

**Academic Integrity:**
The University of Alberta is committed to the highest standards of academic integrity and honesty. Students are expected to be familiar with these standards regarding academic honesty and to uphold the policies of the University in this respect. Students are particularly urged to familiarize themselves with the provisions of the *Code of Student Behaviour* (online at `www.governance.ualberta.ca`) and avoid any behaviour which could potentially result in suspicions of cheating, plagiarism, misrepresentation of facts and/or participation in an offence. Academic dishonesty is a serious offence and can result in suspension or expulsion from the University.

All forms of dishonesty are unacceptable at the University. Any offense will be reported to the Senior Associate Dean of Science who will determine the disciplinary action to be taken. Cheating, plagiarism and misrepresentation of facts are serious offenses. Anyone

who engages in these practices will receive at minimum a grade of zero for the exam or paper in question, and no opportunity will be given to replace the grade or redistribute the weights. As well, in the Faculty of Science the sanction for **cheating** on any examination will include **a disciplinary failing grade** (no exceptions) and senior students should expect a period of suspension or expulsion from the University of Alberta.

**Exams:**
Your student photo I.D. is required at exams to verify your identity. Students will not be allowed to begin an examination after it has been in progress for 30 minutes. Students must remain in the exam room until at least 30 minutes have elapsed. Electronic equipment must not be brought into examination rooms.

**Cell Phones:**
Cell phones are to be turned off during lectures. Cell phones are not to be brought to exams.

**Audio or Video Recording:**
Audio or video recording, digital or otherwise, of lectures, labs, seminars or any other teaching environment by students is allowed only with the prior written consent of the instructor or as a part of an approved accommodation plan. Student or instructor content, digital or otherwise, created and/or used within the context of the course is to be used solely for personal study, and is not to be used or distributed for any other purpose without prior written consent from the content author(s).

**Students Eligible for Accessibility-Related Accommodations (students registered with Student Accessibility Services):**
Eligible students have both rights and responsibilities with regard to accessibility-related accommodations. Consequently, scheduling exam accommodations in accordance with SAS deadlines and procedures is essential. Please note that adherence to procedures and deadlines is required for U of A to provide accommodations. Please contact Student Accessibility Services (`www.ssds.ualberta.ca`) for further information.

**Student Success Centre**:
Students who want to improve their learning and academic capacity (such as better time management, study skills or examination skills) are encouraged to contact the Student Success Centre (2-300 Students' Union Building).

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**Disclaimer:**

Any typographical errors in this Course Outline are subject to change; corrections will be announced in class.

A policy about course outlines can be found in §23.4(2) of the University Calendar.

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