

**MATH 929: Functional Analysis II**  
**UNL, Spring 2018**, Section: 001, CRN: 25918  
Lecture: **M, W, F, 10:30-11:20, Avery Hall 119**

- Instructor:** Dr. Adam Larios **Email:** [alarios@unl.edu](mailto:alarios@unl.edu)  
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**Office Hours:** M,W,F, 9:30 am – 10:20 am, or by appointment  
**Web:** [www.math.unl.edu/~alarios2/courses/2018\\_spring\\_M929/content.shtml](http://www.math.unl.edu/~alarios2/courses/2018_spring_M929/content.shtml)
- Prerequisites:** MATH 928 (Functional Analysis I), or permission. You are also expected to be able to write mathematical proofs.
- Textbook:** John B. Conway. *A Course in Functional Analysis (Graduate Texts in Mathematics) 2nd Edition*. Springer, 1994. ISBN: 978-3540960423.
- Contacting me:** The best way to contact with me is by email, [alarios@unl.edu](mailto:alarios@unl.edu). Please put [MATH 929] somewhere in the title and make sure to include your whole name in your email. My office is in Avery Hall, room 305. Drop-ins are welcome during office hours. If you want to meet me at a different time, please email me in advance, and we will try to schedule a time to meet.
- Description:** (From the course catalogue) Banach and Hilbert Spaces, linear operators and functionals, completely continuous operators, spectral theory, integral equations.
- Motivation:** Functional analysis is a deep root that nourishes major branches of mathematics. It is at once simple and intricate, obvious and profound, delicate and unyielding. It has distinction as a subject in its own right, but it is also vital to the study of partial differential equations, quantum mechanics,  $C^*$  algebras, numerical analysis, optimization, probability, topology. It also makes strong appearances in algebraic geometry, number theory, coding theory, and many other areas. Learning to wield the power of functional analysis and to understand its subtiles is essential to the full development of a mathematician.
- Homework:** Homework is designed to help students understand the material, to prepare them for exams, and to give them experience writing programs based on the material. The given exercises represent a minimal assignment. Some students may have to work additional exercises or do additional reading to attain sufficient mastery of the material.
- I may also assign practice exercises that will not be collected. Homework problems must be written neatly in narrative English with mathematics embedded.  $\text{\LaTeX}$  is strongly encouraged, but not required.
- Attendance & Preparation:** There is no textbook that exactly fits the course goals; hence, the lecture notes are the primary record of the course. Regular attendance and attention is therefore critical. It will be helpful for you to browse through the material before it is presented in class.
- Daily attendance for class lectures is expected and is extremely important. While attendance is not recorded, missing even **one** class will put you behind. Note that there is a strong correlation between class absences and poor grades. You are responsible for all material and announcements in class regardless of whether or not you attended. **You are also responsible for making arrangements with another classmate to find out what you missed. You should not ask me to go over material you missed (due to tardiness or absences) during office hours or over email.**

If you know ahead of time that you will miss a deadline, exam date, etc. Please let me know as soon as possible in advance. Reasonable accommodations will be made for university-excused absences.

**Collaboration:** Collaboration is encouraged in this course. However, copying someone else's work and submitting it as your own is unacceptable. This act of academic dishonesty will be prosecuted in accordance with university policy.

**Electronics:** You are not allowed to have on your person during exams or quizzes any device that can access the internet or communicate in any way. Cell phones, Apple watches, etc. should be put away in backpacks/purses. Calculators, laptops, tablets, cell phones, and other non-medical electronic devices are not permitted during exams unless otherwise stated. During class, cell phones should be set on vibrate or off. If you need to take a call, send a text message, etc., please quietly leave the classroom to do so, so that you do not distract other students. You are welcome to return to class quietly when you are finished. If you wish to take notes using an electronic device, you must first demonstrate to me that you can type or write fast enough to do so properly, and that you can do it without distracting others, before the privilege to use such devices may be granted. If you are found to be abusing this privilege, you risk forfeiting it.

**Grading:** Your course grade will be based on a weighted average computed as follows.

Homework:	35%
Quizzes:	5%
Midterms:	$2 \times 20\% = 40\%$
Final Exam:	20%

**Grading:** Your minimal course grade will be computed as follows. All work in the course will be graded according to the following scale:

A: 90, A-: 87, B+: 84, B: 80, B-: 77, C+: 74, C: 70, C-: 67, D+: 64, D: 60, D-: 57

If deemed necessary, minor adjustments to this scale will be made in favor of the students (commonly known as "applying a curve"). A grade of "A+" may be assigned in the case truly exceptional work.

**Make-up exams:** Make-up exams will only be given with written evidence of an official university excused absence.

**Incompletes:** A grade of "incomplete" may be considered if all but a small portion of the class has been successfully completed, but the student in question is prevented from completing the course by a severe, unexpected, and documented event. Students who are simply behind in their work should consider dropping the course.

**ADA Statement:** Students with disabilities are encouraged to contact the instructor for a confidential discussion of their individual needs for academic accommodation. It is the policy of the University of Nebraska-Lincoln to provide flexible and individualized accommodation to students with documented disabilities that may affect their ability to fully participate in course activities or to meet course requirements. To receive accommodation services, students must be registered with the **Services for Students with Disabilities (SSD) office**, 132 Canfield Administration, 472-3787 voice or TTY.

**Grade Questions:** Any questions regarding grading/scoring of homework, exams, or projects must be made within two class days from when they were handed back, or no change in grade will be made.

**NOTE:** Because of privacy rights, I cannot discuss grades over email or telephone. Please do not email me asking about your grade. I will not be able to give you any information. Of course, I am happy to discuss grades in my office.

**Important Dates:** Jan. 15: Martin Luther King Day (no classes)  
Mar. 18-25: Spring semester break (no classes)

**Departmental Grading Appeals Policy:** Students who believe their academic evaluation has been prejudiced or capricious have recourse for appeals to (in order) the instructor, the departmental chair, the departmental appeals committee, and the college appeals committee.

**Final Exam Policy:** Students are expected to arrange their personal and work schedules to allow them to take the final exam at the scheduled time. The final exam for this course is:  
**Friday, May 4, 2017, 7:30 am-9:30 am (same classroom).**

**Disclaimer:** While this syllabus was prepared carefully and according to information available at the beginning of the semester, changes may be necessary in the interest of good teaching. Changes to any of the information above will be announced in class and posted on the class web site. This includes in particular possible updates or corrections to the syllabus, and changes of exam dates. Care has been taken to avoid any conflict between this syllabus and official university policy. Any such conflict, if it exists, is purely accidental, and appropriate measures will be taken to rectify any such mistake. Any major updates or changes to the syllabus will be announced in class, over email, on canvas, or on the course website.

**Tentative List Of Topics:** The following tentative list of topics is a rough and incomplete guide to the material covered in the course, not necessarily in the order below, and subject to change. Think of it more as a traveler's guide of interesting sites to look out for on the journey ahead.

Likely topics

- Topological preliminaries
- Arzela-Ascoli Theorem
- Urysohn's Lemma
- Locally convex spaces and Fréchet spaces
- Reflexivity and Metrizability
- Banach-Alaoglu Theorem
- Krein-Milman Theorem
- Stone-Weierstrass Theorem on  $C(X)$
- Stone-Čech compactification
- Weak convergence
- Relations to distribution theory
- Banach adjoints
- Tikhonov's Theorem on compactness in the product topology
- The spectral theory of bounded normal operators
- The functional calculus

Possible additional topics

- Hardy Spaces  $H^p$
- $C^*$ -algebras
- Gelfand representation
- Fredholm theory
- Unbounded operators