

MATH 6361
Applicable Analysis II
Spring 2022

Class: TuTh 11:30am-12:50pm, AH (Agnes Arnold Hall) 301

Instructor: Bernhard Bodmann, *bgb@math.uh.edu*

Office: PGH 604; Tu 1:30-3pm, We 1-2pm

Objectives: This course continues the first term, covering topics in analysis that are motivated by applications. The second term starts with approximation strategies in Hilbert spaces and Fourier analysis. Special regard is given to weak convergence and compactness. Next, we study the spectral theory of normal operators. The course concludes with results from compressed sensing, in which properties for ℓ^p -spaces with $p = 1$ and $p = 2$ are combined. The students are assumed to be familiar with properties of sets and functions in Euclidean spaces such as in Math 4331, as well as elementary linear algebra as covered in Math 2331 or Math 4355.

Contents:	<i>Topic</i>	<i>Duration</i>
	Hilbert spaces	best approximation 2 weeks
	Weak convergence	compactness 2 weeks
	Fourier series	convergence 1 week
	Linear operators	spectral theorem 2 weeks
	Integral operators	Fredholm alternative 1 week
	Convex sets in Euclidean space	Carathéodory 1 week
	Separation theorems	convex projections 1 week
	Elements of compressed sensing	linear programming 2 weeks

Prerequisites: Math 4331 and elementary linear algebra.

Text: John Hunter and Bruno Nachtergaele, Applied Analysis, available online at <https://www.math.ucdavis.edu/~hunter/book/pdfbook.html>
 Another book from which I may draw supplementary material: Kenneth Davidson and Allan Donsig, Real Analysis and Applications, Theory in Practice, Springer, New York, 2010. Some very recent topics will be worked out based on Simon Foucart and Holger Rauhut, A Mathematical Introduction to Compressed Sensing, Birkhäuser, 2013.

Assignments: There will be approximately 10 homework sets.

Exams, Grades: The midterms are in class, March 10 and April 14, the final as scheduled by the registrar. The midterms count 20% each, homework and final contribute 30% to your grade.

Disabilities: If there are aspects of the instruction or design of this course that result in barriers to your inclusion or accurate assessment or achievement, please notify the instructor as soon as possible. Students are also welcome to contact the Center for Students with DisABILITIES at 713-743-5400 or JDCenter@central.uh.edu to discuss a range of options to removing barriers in the course, including reasonable academic adjustments/auxiliary aids in accordance with the Section 504 of the Rehabilitation Act of 1973 and the Americans with Disabilities Act of 1990 guidelines.

Counseling: Counseling and Psychological Services (CAPS) can help students who are having difficulties managing stress, adjusting to college, or feeling sad and hopeless. You can reach CAPS (www.uh.edu/caps) by calling 713-743-5454 during and after business hours for routine appointments or if you or someone you know is in crisis. No appointment is necessary for the “Let’s Talk” program, a drop-in consultation service at convenient locations and hours around campus, see

<https://uh.edu/caps/outreach/lets-talk/>

CoViD Mitigation: To reduce the spread of COVID-19, the University strongly encourages everyone (vaccinated or not) to wear face coverings indoors on campus including classrooms for both faculty and students.

Your presence in class each session means that you:

- Are NOT exhibiting any Coronavirus Symptoms that makes you think that you may have COVID-19
- Have NOT tested positive or been diagnosed for COVID-19
- Have NOT knowingly been exposed to someone with COVID-19 or suspected/presumed COVID-19

If you are experiencing any COVID-19 symptoms that are not clearly related to a pre-existing medical condition, do not come to class. Please see Student Protocols

<https://www.uh.edu/covid-19/guidelines-protocols/diagnosis-symptoms/#students>

for what to do if you experience symptoms and Potential Exposure to Coronavirus for what to do if you have potentially been exposed to COVID-19. Consult the Graduate Excused Absence Policy for information regarding excused absences due to medical reasons, see

<https://uh.edu/provost/policies-resources/student/excused-absence-policy>

CoViD Information: Students are encouraged to visit the University’s COVID-19 website at

<https://uh.edu/provost/policies-resources/covid19/>

for important information including on-campus testing, vaccines, diagnosis and symptom protocols, campus cleaning and safety practices, report forms, and positive cases on campus. Please check the website throughout the semester for updates. Data suggests that vaccination remains the best intervention for reliable protection against COVID-19. Students are asked to familiarize themselves with pertinent vaccine information, consult with their health care provider. The University strongly encourages all students, faculty and staff to be vaccinated. For more information, see

<https://uh.edu/provost/policies-resources/covid19/>

Excused Absences: Regular class attendance, participation, and engagement in coursework are important contributors to student success. Absences may be excused as provided in the University of Houston Undergraduate Excused Absence Policy and Graduate Excused Absence Policy for reasons including: medical illness of student or close relative, death of a close family member, legal or government proceeding that a student is obligated to attend, recognized professional and educational activities where the student is presenting, and University-sponsored activity or athletic competition. Under these policies, students with excused absences will be provided with an opportunity to make up any quiz, exam or other work that contributes to the course grade or a satisfactory alternative. Please read the full policy for details regarding reasons for excused absences, the approval process, and extended absences. Additional policies address absences related to military service, religious holy days, pregnancy and related conditions, and disability.

Recording of Classes: Students may not record all or part of class, livestream all or part of class, or make/distribute screen captures, without advanced written consent of the instructor. If you have or think you may have a disability such that you need to record class-related activities, please contact the Justin Dart, Jr. Student Accessibility Center. If you have an accommodation to record class-related activities, those recordings may not be shared with any other student, whether in this course or not, or with any other person or on any other platform. Classes may be recorded by the instructor. Students may use instructor's recordings for their own studying and note-taking. Instructor's recordings are not authorized to be shared with anyone without the prior written approval of the instructor. Failure to comply with requirements regarding recordings will result in a disciplinary referral to the Dean of Students Office and may result in disciplinary action.

Syllabus Changes: Due to the changing nature of the COVID-19 pandemic, please note that the instructor may need to make modifications to the course syllabus and may do so at any time. Notice of such changes will be announced as quickly as possible by email and through the modification of this document on the course website.