CSE396 THEORY OF NON SELF-AJOINT OPERATORS

Fall 2024, # 65084, T Th 9:00-10:30, UTC 4.120

Textbook:
L. Demkowicz, *Lecture Notes on Non-Self Adjoint Operators and Related Topics*,
can be downloaded from:

https://users.oden.utexas.edu/∼leszek

(bottom of the page).

The class focuses on fundamentals of the theory of non-self adjoint operators. We will follow closely the lecture notes listed above that have been extracted from the books of Gohberg and Krein [2], and Levin [3]. As a starting point, we assume that the reader is familiar with our textbook [1].

For CSEM students, the class requires a substantial mathematical background corresponding to CSE 386M (Functional Analysis), CAM 386L (Mathematical Methods in Applied Mechanics) and CSE 386C (Methods of Applied Mathematics) classes or their equivalents.

CLASS OUTLINE SCHEDULE:

1. Preliminaries: Polar Representation of a Bounded Operator, Regular Eigenvalues of a Bounded Operator, Compact operators.

2. Weyl's Results: Weyl's Lemmas, Weyl's Majorant Theorem, Nuclear Operators.

3. Elements of Theory of Entire Functions: Jensen's Formula and the Counting Function, Convergence Exponent of Sequence of Zeros, Weierstrass Products, Phragmén and Lindelöf Result.

4. Macaev's Results: Additional Properties of Singular Values, Determinant of an Operator, A Resolvent Estimate, Macaev's Result.

5. Keldyš' Results: Keldyš' Lemma, Keldyš' Theorems.

7. Non-orthogonal Bases: Introduction to Non-orthogonal Bases, Riesz Bases, Bari Bases, Glazman's Criterion for Eigenvectors of a Dissipative Operator to Form a Basis.

References:

[1] J.T. Oden and L.F. Demkowicz. Applied Functional Analysis for Science and Engineering. Chapman & Hall/CRC Press, Boca Raton, 2018. Third edition.

[2] I.C. Gohberg and M.G. Krein. Introduction to the Theory of Linear Nonselfadjoint Operators in Hilbert Space. American Mathematical Society, Providence, 1965.

[3] B. Ya. Levin. Lectures on Entire Functions. American Mathemtical Society, 1996.

The class will be conducted in a seminar style. No exams (including final) will be given. Instead, problems with varying difficulty, ranging from ”hard theory”, to practice exercises will be assigned in the class on a continuous basis. Each problem will be worth a number of points (5-20). The final grade will be determined by the number of collected points.

If there is a significant interest in the class from outside university, the class will be taught online.

Final score range	grade
100 and above	A+
80 - 100	A
60 - 80	B
40 - 60	C
20 - 40	D
00 - 20	F

Discussion session: Fri, 4:30-5:30. POB 6.304.

Instructor: Dr. Leszek Demkowicz, POB 6.326, Office hours: immediately after the class.