

## Lecture plan TATM85 Funktionalanalys HT2023

(preliminary)

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28/8	Lecture 1	Metric spaces, open sets	<b>Kreyszig 1.1–1.3</b>
29/8	Lecture 2	Quantifiers, closed sets, convergence	<b>Kr 1.3, 1.4</b>
1/9	Lecture 3	Continuity, Cauchy sequences, Completeness	<b>Kr 1.3-1.5</b>
4/9	Lecture 4	Compactness	<b>Kr 2.5, Notes</b>
5/9	Lecture 5	More on compactness + examples, completion	<b>Kr 2.5, (1.6) Notes</b>
8/9	Lecture 6	Normed and Banach spaces	<b>Kr 2.2-2.5</b>
11/9	Lecture 7	Series in Banach spaces, Schauder basis	<b>Kr 2.2-2.5</b>
12/9	Lecture 8	Integration theory, outer measure,	<b>Beals Ch. 10, Notes</b>
14/9		<b>Hand in Assignment 1, Le 1–5</b>	
15/9	Lecture 9	Measurable sets, Lebesgue measure	<b>Beals Ch. 10, Notes</b>
18/9	Lecture 10	Measurable functions, Lebesgue integral	<b>Beals Ch. 11, Notes</b>
19/9	Lecture 11	Convergence theorems, $L^p$ norm	<b>Beals Ch. 11, Notes</b>
22/9	Lecture 12	$L^p$ spaces, Hölder inequality	<b>Beals Ch. 12, Notes</b>
25/9	Lecture 13	Inner product and Hilbert spaces, orthogonal projection	<b>Kr 3.1-3.3</b>
29/9	Lecture 14	Orthogonal projection, examples, ON-sequences	<b>Kr 3.3-3.6</b>
2/10	Lecture 15	ON-bases, Linear operators and functionals	<b>Kr 3.5, 3.6, 3.8, (2.6, 2.8)</b>
3/10	Lecture 16	More on bounded linear operators and functionals	<b>Kr (2.6), 2.7, 2.8, 2.10</b>
3/10		<b>Hand in Assignment 2, Le 6–12</b>	
6/10	Lecture 17	Duals	<b>Kr 2.10</b>
16/10	Lecture 18	Banach fixed point theorem and applications	<b>Kr 5.1, 5.3, 5.4</b>
16/10		<b>Hand in Assignment 3, Le 13–16</b>	
30/10	Lecture 19	Hahn–Banach theorem	<b>Kr (4.1), 4.2, 4.3</b>
31/10	Lecture 20	Consequences of H-B theorem, weak convergence	<b>Kr 4.3, 4.8</b>
3/11	Lecture 21	Weak convergence, second dual, reflexive spaces	<b>Kr 4.6, 4.8-4.9</b>
7/11	Lecture 22	Weak* convergence, Banach–Alaoglu theorem	<b>Kr 4.8-4.9, Notes</b>
10/11	Lecture 23	Baire and Banach–Steinhaus theorems	<b>Kr 4.7, Notes</b>
14/11	Lecture 24	Open mapping and closed graph	<b>Kr 4.12-4.13</b>
17/11	Lecture 25	Compact operators	<b>Kr 8.1, 8.7</b>
20/11	Lecture 26	Fredholm alternative, adjoint operators	<b>Kr 8.2, 8.5-1, 8.6-1, 8.7</b>
21/11	Lecture 27	Fredholm alternative, Examples, Spectrum	<b>Kr 8.2, 8.7</b>
23/11		<b>Hand in Assignment 4, Le 17–23</b>	
24/11	Lecture 28	Spectral theory	<b>Kr 7.2-7.5</b>
28/11	Lecture 29	Spectral theorem for compact self-adjoint operators	<b>Kr 9.1-9.2, 8.3, Notes</b>
1/12	Lecture 30	Final examples, Sturm–Liouville problem	Notes
12/12		<b>Hand in Assignment 5, Le 24–30</b>	