

MAT4540/9540: SYLLABUS FALL 2019

1. HOMOTOPY THEORY

From “Lecture notes on homotopy theory and applications”: Chapter 1.

A more detailed overview:

- All of §1.1–§1.2.
- §1.3: only definitions. Proof of Prop. 1.3.2 not required.
- All of §1.4–§1.5.
- §1.6: all except Remark 1.6.7.
- §1.7: all except Example 1.7.5.
- §1.8–§1.12: all.
- §1.13: all except Prop. 1.13.2.

Important results: Cellular approximation, Hurewicz, Whitehead, CW approximation, homotopy groups of spheres, long exact sequence of a fibration, examples of fibrations.

2. SPECTRAL SEQUENCES

From “Lecture notes on homotopy theory and applications”: Chapter 2.

A more detailed overview:

- §2.1–§2.2: all.
- §2.3: nothing except knowing what the edge homomorphism is.
- §2.4: only a rough overview of the statement and ingredients in the Hurewicz theorem mod \mathcal{C} and Theorem 2.4.2 is required.
- None of §2.5.
- §2.6: all.
- §2.7: all, and also knowledge of the properties of cohomology groups that are used in the spectral sequence computations.
- §2.8: all except Example 2.8.2.
- §2.9–§2.11: all.
- None of §2.12.

Important results: Computations of homotopy groups of spheres, Serre’s finiteness theorem (Theorem 2.11.1). Know how to use spectral sequences in computations.

3. K -THEORY

From “Characteristic classes and K -theory”: Chapters 1–3.

A more detailed overview:

- §1.1: all. Details in §1.1.4 not required.
- §1.2: only a rough knowledge of the definitions is required.
- §1.3–§1.4: all.
- §1.5: definition of clutching, know the statement of the result.
- §2.1–§2.5: know the definitions and statement of results. Detailed proofs not required.
- §2.6–§2.7: all.
- §2.8: Examples 2.8.1–2.8.2.
- §2.9–§2.10: none.

- §3.1–§3.3: all.
- §3.4: all. Detailed proofs not required.
- §3.5–§3.6: all.

From A geometric introduction to K -theory: §29 up until and including 29.15.

Important results: E_2 -page of the Atiyah–Hirzebruch spectral sequence, computations for $\mathbb{C}\mathbb{P}^n$ (including the multiplicative structure) and $\mathbb{R}\mathbb{P}^n$.