

Set Theory

2026 Fall

Neptun Code: BMI-LOTD17-204E.01, BMA-LOTD17-204.02

Lecturer: Zalán Molnár

General aim of the course:

Set theory is a branch of mathematical logic providing a foundation for mathematics. This course introduces all the basic concepts and results of Zermelo-Fraenkel set theory with axiom of choice (ZFC), which are inevitable for any further studies in mathematical logic. Although no specific mathematical background is required, we assume a certain level of maturity in abstract thinking in order to acquire the material.

General content of the course:

- **Class 1-3.** Axiom of extensionality, Axiom of empty set, Axiom of pairs, Axiom of unions, Axiom of separation, Axiom of powerset, Axiom of infinity, Axiom of replacement, basic notions (eg. union, intersection, indexed family, ordered pairs, relations)
- **Class 4-5.** Axiom of foundation, Axiom of choice, Cantor's theorem, Schröder-Bernstein theorem, Countable of countable unions is countable.
- **Class 6.** Applying the axioms, Well orderings, transitive sets
- **Class 7.** Ordinal numbers, Axiom of replacement, Well-ordering theorem
- **Class 8.** Transfinite recursion, transfinite induction,
- **Class 9.** Ordinal arithmetics
- **Class 10.** Cardinal numbers
- **Class 11.** Cardinal arithmetics
- **Class 12.** Zorn's Lemma & applications
- **Class 13.** Continuum hypothesis, glimpse to large cardinals, conclusion

Evaluation

Students will be evaluated based on:

- homework assignments
- oral exam

References

- [1] Paul R. Halmos. *Set Theory*. Springer. 1974.
- [2] András Hajnal, Peter Hamburger. *Naive Set Theory*. London Mathematical Society. 1999.
- [3] Thomas Jech. *Set Theory*. Springer. 2006.
- [4] Lecture notes