

## LECTURE GEOMETRY AND TOPOLOGY – MATH3061

### Disclaimer

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Nobody is perfect, and I might have written or said something silly. If there is any doubt, then please check the references or contact me. All questions welcome!

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This document is for the topology part of the course only. The first 6 weeks are on geometry.

### Who?

Second semester students in Mathematics interested in a mixture of (linear) geometry and discrete mathematics, but everyone is welcome.

### Where and when?

- ▶ The lecture.
  - ▷ Monday 10:00-11:00, Thursday 09:00-10:00, Friday 09:00-10:00.
  - ▷ Starting 7th week, ending 12th week.
  - ▷ Carlaw Lecture Theatre 275 and online via zoom.
- ▶ The tutorials.
  - ▷ Friday 13:00-14:00.
  - ▷ Starting 8th week, ending 13th week.
  - ▷ Carlaw Seminar Room 350.

### Material for the lecture

- ▶ There is a script [Hi11] available via Canvas that the lecture will follow. Additional literature (not mandatory but recommendations only). The recommended literature from the course outline is [Ad94], [Bl67] and [FiGa91]. The lecture sometimes takes a different perspective and I sometimes borrow the exposition from [Ba10], [BoMu08], [BrHa12], [We96] or [Wi96] for graphs, and from [A+21], [FaSt96] and [Ka93] for surfaces and knots.
- ▶ Website [www.dtubbenhauer.com/lecture-geotop-2022.html](http://www.dtubbenhauer.com/lecture-geotop-2022.html)
- ▶ Prerecorded lectures on the “What is...algebraic topology?” and “What is...geometric topology?” playlists here:  
[www.youtube.com/c/VisualMath/playlists](http://www.youtube.com/c/VisualMath/playlists)
- ▶ One exercise sheet per week; six in total.

### Schedule.

- ▶ Week 7. Basics about graphs – Graphs, subdivision, trees, Eulerian circuits.
- ▶ Week 8. Surfaces I – Various surfaces, homeomorphism, Euler characteristic.
- ▶ Week 9. Surfaces II – Invariance under subdivision, cutting and pasting, orientation.
- ▶ Week 10. Surfaces III – Classification of surfaces.
- ▶ Week 11. Graphs and surfaces – Graphs on surfaces, planar graphs.
- ▶ Week 12. Knots – Knots diagrams, knot coloring, Seifert surfaces.

## REFERENCES

- [Ad94] C.C. Adams. The knot book. An elementary introduction to the mathematical theory of knots. Revised reprint of the 1994 original. American Mathematical Society, Providence, RI, 2004. xiv+307 pp.
- [A+21] Edited by C. Adams, E. Flapan, A. Henrich, L.H. Kauffman, L.D. Ludwig and S. Nelson. Encyclopedia of knot theory. CRC Press, Boca Raton, FL, [2021], ©2021. xi+941 pp.
- [Ba10] R.B. Bapat. Graphs and matrices. Universitext. Springer, London; Hindustan Book Agency, New Delhi, 2010. x+171 pp.
- [Bl67] D.W. Blakett. Elementary topology. A combinatorial and algebraic approach. Academic Press, New York-London 1967 ix+224 pp.
- [BoMu08] J.A. Bondy, U.S.R. Murty. Graph theory. Graduate Texts in Mathematics, 244. Springer, New York, 2008. xii+651 pp.
- [BrHa12] A.E. Brouwer, W.H. Haemers. Spectra of graphs. Universitext. Springer, New York, 2012. xiv+250 pp.
- [FaSt96] D.W. Farmer, T.B. Stanford. Knots and surfaces. A guide to discovering mathematics. Mathematical World, 6. American Mathematical Society, Providence, RI, 1996.
- [FiGa91] P.A. Firby, C.F. Gardiner. Surface topology. Second edition. Ellis Horwood Series: Mathematics and its Applications. Ellis Horwood, New York; distributed by Prentice Hall, Inc., Englewood Cliffs, NJ, 1991. 220 pp.
- [Hi11] J. Hillman. Topology. Lecture notes for the Topology component of Geometry and Topology. Available via Canvas.
- [Ka93] L.H. Kauffman. Knots and physics. Second edition. World Scientific Publishing Co., Inc., River Edge, NJ, 1993. xiv+723 pp.
- [We96] D.B. West. Introduction to graph theory. Prentice Hall, Inc., Upper Saddle River, NJ, 1996. xvi+512 pp.
- [Wi96] R.J. Wilson. Introduction to graph theory. Fourth edition. Longman, Harlow, 1996. viii+171 pp.

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