

# MATH 541: Topics in Topology

Fall 2008, MWF 11:00–11:50 Keiko Kawamuro

## Topics of this course

Knowledge of basic homology theory will be assumed. This course is aimed at second year math graduate students.

- 2-handle attachments.
- Normal bundle and framings of a knot.
- Dehn surgery.
- Blow up and blow down.
- Handle sliding.
- 1-handle and 2-handle cancellation.
- Fiber knots in  $S^3$ .
- Hopf bands and Dehn twists.
- Murasugi sum and plumbing.
- Gabai's theorem and open book decompositions of 3-manifolds.
- Harer's theorem and Harer twists.
- Melvin-Morton fiber knot.
- Genus of a knot and a fiber surface.
- The standard contact structure of  $S^3$ .
- Contactomorphism and contact isotopy.
- Giroux correspondence.
- Thurston-Winkelnkemper construction.
- Branched covering. Hilden-Montesinos theorem.
- Alexander theorem of open book decomposition.
- Martinet's theorem of contact structure.
- Gray stability theorem.
- Transversal knots and Legendrian links.
- Self linking number and Euler number.
- Characteristic foliation.
- Thurston-Bennequin number and rotation number.
- Contact surgery.

## Grade

Grade is based on couple of assignments given during lectures and a presentation at the end of the semester.

## References

- Rolfsen, Dale Knots and links. Mathematics Lecture Series, No. 7. Publish or Perish, Inc., Berkeley, Calif., 1976.
- Lickorish, W. B. Raymond An introduction to knot theory. Graduate Texts in Mathematics, 175. Springer-Verlag, New York, 1997.
- Geiges, Hansjrg An introduction to contact topology. Cambridge Studies in Advanced Mathematics, 109. Cambridge University Press, Cambridge, 2008.
- Ozbagci, Burak; Stipsicz, Andrs I. Surgery on contact 3-manifolds and Stein surfaces. Bolyai Society Mathematical Studies, 13. Springer-Verlag, Berlin; Jnos Bolyai Mathematical Society, Budapest, 2004.
- Etnyre, John B. Legendrian and transversal knots. Handbook of knot theory, 105–185, Elsevier B. V., Amsterdam, 2005.
- Etnyre, John B. Introductory lectures on contact geometry. Topology and geometry of manifolds (Athens, GA, 2001), 81–107, Proc. Sympos. Pure Math., 71, Amer. Math. Soc., Providence, RI, 2003.
- Etnyre, John B. Lectures on open book decompositions and contact structures. Floer homology, gauge theory, and low-dimensional topology, 103–141, Clay Math. Proc., 5, Amer. Math. Soc., Providence, RI, 2006.