Math 8230: Topics in Topology and Geometry

Email: akram.alishahi@uga.edu
Time and Place: Tuesday-Thursday: 11:10am--12:25pm at Boyd 326
Course webpage:
Office hours: By appointment

References:

- Classical knot theory:
  - Lickorish: *An Introduction to Knot Theory*
  - Teichner: *Slice knots: knot theory in the 4th dimension*
  - Livingston, Naik: *Introduction to Knot Concordance*
- Khovanov homology:
  - Lipshitz, Rasmussen, Sarkar: *A book on Khovanov homology*
  - Bar-Natan: *Khovanov's homology for tangles and cobordisms*
  - Khovanov: *A functor-valued invariant of tangles*
  - Rasmussen: *Khovanov homology and the slice genus*
  - Gompf, Stipsicz: *Four-manifolds and Kirby Calculus*
  - Lawson, Lipshitz, Sarkar: *The cube and the Burnside category*
  - Lipshitz, Sarkar: *Spatial refinements and Khovanov homology*
  - Plamenevskaya: *Transverse knots and Khovanov homology*
- Knot Floer homology:
  - Manolescu, Ozsváth, Szabó, Thurston: *On combinatorial link Floer homology*
  - Ozsváth, Stipsicz, Szabó: *Grid homology for knots and links*
  - Ozsváth, Szabó, Thurston: *Legendrian knots, transverse knots and combinatorial Floer homology*

Prerequisite: The course will assume a basic understanding of smooth manifolds and some topology.

Description: This course is an introduction to modern knot invariants, specifically, Khovanov homology and knot Floer homology.

Homework: Registered students are expectedly to regularly attend class. Suggested homework will be given roughly biweekly. Students are required to turn in the solution to one homework problem by the middle of the semester and a second homework problem by the end of the semester.

Exam: This course does not have a final exam.

Academic honesty: As a University of Georgia student, you have agreed to abide by the Universitys academic honesty policy, A Culture of Honesty, and the Student Honor Code. All academic work must meet the standards described in A Culture of Honesty found at: www.uga.edu/honesty. Lack of knowledge of the academic honesty policy is not a reasonable explanation for a violation. Questions related to course assignments and the academic honesty policy should be directed to the instructor.

Tentetive Schedule:

Week	Topics
1	Course overview. Basics of knot theory
2	Slice knots and knot concordance group, Alexander polynomial
3	Jones polynomial, HOMFLY-PT polynomial
4	Khovanov homology, Examples, Properties, Invariance
5	Khovanov homology for cobordisms and tangles
6	Deformations of Khovanov homology, s-invariant, exotic smooth structure on R^4
7	Invariants of surfaces, Torsion and topological applications
8	Khovanov stable homotopy type
9	Spring Break
10	Grid Diagrams and knot Floer homology, tau invariant
11	Combinatorial proof of invariance
12	Invariants of Legendrian and transverse knots
13	Heegaard diagrams and holomorphic disks
14	Surgery formulas and applications
15	Spectral sequences
16	Detection results