

# MATH 285Z: SUTURED 3-MANIFOLDS AND FLOER HOMOLOGY

Spring 2024

<b>Instructor:</b>	Fan Ye	<b>Time:</b>	3:30-4:15 pm, M-W
<b>Email:</b>	<a href="mailto:fanye@math.harvard.edu">fanye@math.harvard.edu</a>	<b>Place:</b>	TBA

**Course Page:** [??](#)

**Course Assistant:** TBA

**Office Hours:** Fan Ye, SC 505H, TBA.

**Prerequisites:**

- Differential geometry, especially principal bundle. Ref: a) Differential Geometry: Bundles, Connections, Metrics and Curvature, Chapters 1-16, Clifford H. Taubes; b) An Introduction to Differentiable Manifolds and Riemannian Geometry, William M. Boothby; c) Fundations of differentiable manifolds and Lie groups, Frank W. Warner.
- Algebraic topology, especially homology theory, characteristic classes, and spectral sequences. Ref: a) Algebraic Topology; b) Vector Bundles and K-Theory; both by Allen Hatcher <https://pi.math.cornell.edu/~hatcher/>; c) Differential forms in algebraic geometry, Chapters 4-5, Raoul Bott and Loring W. Tu, <https://link.springer.com/book/10.1007/978-1-4757-3951-0>.
- 3-manifold topology. Ref: Notes on Basic 3-Manifold Topology, Allen Hatcher, also in the above link.

**Tentative Course Outline:** Most references are papers. Notes will be posted on the course page after the classes.

- Weeks 1-2 (Jan. 22-31): Introduction to sutured manifolds. Ref: TBD
- Weeks 3-4 (Feb. 5-14): Sutured Heegaard Floer homology. Ref: TBD
- Weeks 5-6 (Feb. 19-28, with a holiday on Feb. 19): Sutured monopole Floer homology. Ref: TBD
- Weeks 7-9 (Mar. 4-20, with spring break during Mar. 9-17): Sutured instanton Floer homology. Ref: TBD
- Weeks 10-11 (Mar. 25-Apr. 3): Contact elements and surgery exact triangles. Ref: TBD
- Weeks 12-14 (Apr. 8-24): Towards isomorphism of Floer homology. Ref: TBD

**Grading Policy:** Homework (60% = 5 × 12%) and Final exam (40%).

**Homework:** There will be 6 assignments, posted on the course page every two weeks, which are related to the materials in the next two weeks. The first assignment will be posted on Jan. 24. The homework should be submitted via Canvas (see Important Dates for the exact dates). Late homework is accepted only by my permission. LaTeX, scanned copies, photos of writings, and any other types of writings are accepted if they are clear and understandable. The lowest homework score will be dropped and it is allowed to only finish and submit homework for 5 times.

**Final Exam:** There will be a take-home final exam, posted on the course page on Apr. 24. It should be submitted via Canvas before May 1.

**Collaboration:** Discussion and collaboration are encouraged for homework but students should write up their own solutions. It is good to write the names of collaborators on the first page of the homework. Collaboration on the final exam is prohibited.

**Important Dates:**

Jan. 24, Wed .....	Assignment 1 will be posted
Feb. 7, Wed .....	Assignment 2 will be posted
Feb. 19, Mon .....	University Holiday: Presidents' Day
Feb. 21, Wed, 11:59 pm .....	Deadline of Assignment 1
Feb. 21, Wed .....	Assignment 3 will be posted
Mar. 6, Wed, 11:59 pm .....	Deadline of Assignment 2
Mar. 6, Wed .....	Assignments 4 will be posted
Mar. 9-17, Sun-Sun .....	Spring break
Mar. 20, Wed .....	Assignment 5 will be posted
Mar. 27, Wed, 11:59 pm .....	Deadline of Assignment 3
Apr. 3, Wed, 11:59 pm .....	Deadline of Assignments 4
Apr. 3, Wed .....	Assignment 6 will be posted
Apr. 17, Wed, 11:59 pm .....	Deadline of Assignment 5
Apr. 24, Wed, 11:59 pm .....	Deadline of Assignment 6
Apr. 24, Wed .....	Final exam will be posted
May 1, Wed, 11:59 pm .....	Deadline of final exam