This is a course on the mathematical foundations of topological quantum computation. We consider this subject as part of the quantum mathematics which centers on the quantum nature of space and space-time captured by topological quantum field theories and higher algebroid structures. The topics may change depending upon audience feedback. Therefore, participants are encouraged to help shape the course with questions and comments.

1. Tentative Plan

Topics will be chosen from the following:

(1) Quantum Matters
(2) Atiyah-Segal Type TQFTs
(3) Fusion and Modular Categories
(4) From Categories to TQFTs
(5) Schwarz Type TQFTs

(6) Jones-Kauffman Theories
(7) Classification of Algebroids
(8) Modeling Quantum Hall States
(9) Anyonic Quantum Computers

(10) Higher Algebroid Theories
(11) Symmetry Enriched TQFTs
(12) Witten Type TQFTs

The tentative plan is to cover topics (1)-(5) in Winter 2014, (6)-(9) in Fall 2014, and (10)-(12) in Fall 2015. The topics are structured as independently as possible so people can take later courses with minimal material from the previous ones.

2. Course Grade

There will be no regular homework assignments, but there will be many questions and projects to think and work on. If you register for a grade, your course grade will be based on participation in the course as there will be no exams either. Any nontrivial research/observation will automatically result in an A (nontriviality is on the instructor's scale.)

3. Textbooks

There are no textbooks as there are none available. My CBMS monograph posted here can be used as a guide for the literature. One purpose of the course is to work towards a future book so lecture notes will be posted as soon as possible. You are welcome to urge the instructor when he falls behind!