SYLLABUS.

PART III, MORSE HOMOLOGY, 2011

HTTP://MORSEHOMOLOGY.WIKISPACES.COM

Policies.

◇ **Exercise classes:** there will be three classes to discuss homeworks this term (and a fourth one before exams), they are:

Tuesday February 8, room MR11, 2-3pm.
Tuesday February 22, room MR12 (not 11!), 2-3pm.
Tuesday March 8, room MR11, 2-3pm.

◇ **Homeworks:** I will hand out 2 exercises per lecture. Since they are not graded, it is up to you to decide what to do with them. This policy is supposed to encourage you to read your notes, which in turn means you will understand the next lecture (otherwise you won't, as in all Part III courses). You are encouraged to work on homeworks together. You can discuss homeworks on the above wikispaces page.

◇ **Lecture notes:** Writing fast lecture notes is an essential warm-up for all your Part III Exams.

◇ **Exams:** a typical question is bookwork+thinking, so I ask you to reprove some important result from class, and then there's a harmless thinking question (harmless means it is either very similar to a homework question, or it is a relatively straightforward consequence of the result you proved).

Tentative course contents for the first 14 of 24 lectures

Lecture 1. Overview of the course: computing Morse homology.
Lecture 2. Review of Riemannian geometry (connections, metric, exp)
Lecture 3. Differential topology (regular maps, Sard's theorem, transversality)
Lecture 4. Parametric transversality theorem, Morse functions and properties
Lecture 5. Review of Banach spaces, Banach manifolds
Lecture 6. Fredholm theory, Sard-Smale theorem
Lecture 7. Flowlines, topology of sublevel sets
Lecture 8. Handle-attachments, handle-attaching theorem, stable/unstable mfds
Lecture 9. Morse-Smale metric, classical vs modern, Morse vs Floer homology
Lecture 10. Sobolev spaces
Lecture 11. Sobolev spaces for manifolds, setting for Transversality theorem
Lecture 12. Transversality theorem, review of Hilbert spaces
Lecture 13. Fredholm property for $\partial_s + A_s$
Lecture 14. Index calculation via the spectral flow