# Contact topology and Riemann's moduli space

**Level of course**
PhD Course

**Semester/quarter**
3rd + 4th quarter (Spring 2011)

**Hours per week**
4

**Names of lecturers**
Doug LaFountain and Bob Penner

**Objectives of the course**
This course will be an introduction to contact topology, with a goal towards understanding contact homology and its connections with the combinatorics of Riemann's moduli space.

**Course contents**
Over the last ten years, contact homology has proven to be a robust and flexible way to address both the classification of contact structures, as well as other problems in contact topology. Furthermore, contact homology sits inside a much broader Symplectic Field Theory, which offers new connections with many areas of active research, including Gromov-Witten invariants, Floer homology, and string topology.

The following specific topics will be addressed:

1. Contact forms, contact structures, contact manifolds, and Legendrian submanifolds

2. Dynamics of Reeb vector fields

3. Symplectization, $J$-holomorphic curves, and associated moduli spaces

4. Contact homology and applications

5. Connections with Teichmüller theory and Riemann's moduli space

6. A brief look at Symplectic Field Theory

**Literature**
Our approach will be to sample from a number of different books and papers throughout the semester. However, there are three main texts that will form a foundation from which much of the material will be drawn.

For the contact topology portion:

H. Geiges, *Introduction to Contact Topology*, Cambridge University Press, 2008.

For the portion on moduli spaces of $J$-holomorphic curves:

D. McDuff and D. Salamon, *J-holomorphic Curves and Quantum Cohomology*, AMS University Lecture Series Vol. 6, 1994.

For the portion on Teichmüller theory and Riemann's moduli space:

R.C. Penner, *Decorated Teichmüller Theory*, preprint, 2010.

**Teaching methods**
4 hours of lectures per week

**Assessment methods**
Passed / not passed will be based on the students participation in the course

**Credits**
10 ECTS

**Language of instruction**
English

**Course enrolment**
Please send an e-mail to Maiken Kirdorf Nielsen, maiken@imf.au.dk