MATHEMATICS 728 A1
Algebraic Topology II
Spring Semester 2006

Instructor: Takashi Kimura
e-mail: kimura@math.bu.edu
Phone: (617)353-1486 **Office:** MCS 234

Lectures: MWF 2-3 in MCS B31

My Office Hours: TBA

Web Page: http://math.bu.edu/people/kimura/Teaching/Spring06/728/

Text: *Differential Forms in Algebraic Topology*, by Raoul Bott and Loring W. Tu, Springer, ISBN 0387906134. Other material will be introduced as needed.

Content: This course will consist of two parts. During the first part of the course, we will study the algebraic topology of smooth manifolds. In particular, we will study the cohomology of a smooth manifold with values in $\mathbf{R}$ using its description in terms of de Rham cohomology. The de Rham cohomology of a smooth manifold is the cohomology of the complex of differential forms where the differential is the exterior derivative. While some torsion information is lost in this realization, we will be able to use powerful techniques from differential geometry to study de Rham cohomology. Topics covered include the Mayer-Vietoris sequence, the Poincaré Lemma, the Thom isomorphism, the Čech cohomology of a sheaf, the Čech-de Rham double complex, the Thom isomorphism and Poincaré duality, spectral sequences, homotopy theory and Eilenberg-Mac Lane spaces, Chern Classes of a vector bundle, the Splitting Principle, Pontrjagin Classes, Grassmannians and the Universal Bundles. The second part of the course will be run as an advanced topics course with a topic to be chosen with the students in the class. Possible topics include equivariant cohomology and the Atiyah-Bott localization theorem or operads and topological quantum field theory.

Prerequisites: This course requires an understanding of the material in *Algebraic Topology I*, MA 727, algebraic topology at the level of the text *Elements of Algebraic Topology* by J. Munkres. This course also requires a mastery of the material in MA 721 and 722, *Differential Topology I and II*.

Homework: Homework will be assigned periodically. Students may discuss homework with each other (and are encouraged to do so) but all written work must be prepared independently.