Mean Curvature Flow

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Lecture 1 & 2:
Heat equation, gradient estimates for positive solutions, heat kernel, uniqueness, heat equation as a gradient flow, parabolic scalings and parabolic Hausdorff measure and dimension.
Lecture 3 & 4:
Mean curvature flow (MCF), MCF as a gradient flow, parabolic scalings, examples of mean curvature flow, self-similar shrinkers, Huisken's monotonicity, tangent flows, tangent flows are self-similar shrinkers with Euclidean volume growth, F-functional, entropy, F and entropy stability, generic gradient flows avoid unstable critical points.

A few references:

Klaus Ecker, Regularity theory for mean curvature flow. Progress in Nonlinear Differential Equations and their Applications, 57. Birkhauser Boston, Inc., Boston, MA, 2004.

Tobias H. Colding, William P. Minicozzi II, Generic mean curvature flow I; generic singularities, http://arxiv.org/abs/0908.3788

Tobias H. Colding, William P. Minicozzi II, Smooth compactness of self-shrinkers, http://arxiv.org/abs/0907.2594

Brian White, Evolution of curves and surfaces by mean curvature. Proceedings of the International Congress of Mathematicians, Vol. I (Beijing, 2002), 525-538, Higher Ed. Press, Beijing, 2002.

Tom Ilmanen, Singularities of Mean Curvature Flow of Surfaces, preprint, 1995, http://www.math.ethz.ch/~ilmanen/papers/pub.html.