Introduction to Singularity Theory, 201.1.0361, BGU Spring 2017

Lectures: Dmitry Kerner, (Sundays 10:00-12:00, Thursdays 16:00-17:00).
Office hours ([58], room 217, kernerdm@math.bgu.ac.il): https://www.math.bgu.ac.il/en/teaching/hours
The site of the course: https://www.math.bgu.ac.il/~kernerdm

The structure of the final grade
There will be about 10-12 homeworks. There will be one midterm (date: ??).
The final mark is computed as: 10% ( midterm ) + 90% (final exam).
The final exams are: Moed A (7.07.2017) , Moed B (28.07.2017).

Prerequisites
Calculus 3 (201.1.0031), Algebraic Structures (201.1.7031).

Overview
This is the introductory course to the singularities of maps and spaces.
The Singularity Theory began in 19'th century from the two questions:
• How does a curve look locally near its non-smooth point?
• How does the graph of a function look locally near a critical point?
By now this is an active area lying at the crossroad of Algebraic/Analytic/Differential Geometry, Algebraic Topology, Commutative Algebra. (The immediate applications in industry and applied mathematics usually go under the name "The Catastrophe Theory".)
This course is a very basic introduction, accessible to the advanced undergraduates. The course can serve as a good motivation/preparation for the subsequent solid courses in Commutative Algebra/Algebraic Geometry.

Syllabus
(1) An introductory sketch and some motivating examples. Critical points of functions of one variable.
(2) Basic facts about analytic series in several variables. Local Rings and germs of functions/sets. Morse critical points. Degenerate critical points. Singular (non-smooth) points of curves.
(3) Unfoldings and morsifications. Finitely determined function germs.
(5) Time permitting we will concentrate on some of the following topics:
   (a) Blowups and resolution of plane curve singularities;
   (b) Basic topological invariants of plane curve singularities (Milnor fibration);
   (c) Versal deformation and the discriminant.

Bibliography