The Hebrew University of Jerusalem

Syllabus

Topics in Geometric Analysis - 80931

Last update 29-10-2020

HU Credits: 3

Degree/Cycle: 2nd degree (Master)

Responsible Department: Mathematics

Academic year: 0

Semester: 1st Semester

Teaching Languages: Hebrew

Campus: E. Safra

Course/Module Coordinator: Or Hershkovits

Coordinator Email: Or.Hershckovit@mail.huji.ac.il

Coordinator Office Hours:

Teaching Staff:

Dr. Or Hershkovits

<u>Course/Module description:</u>
The course will concern with manifolds with Ricci curvature bounds and their limits (Cheeger-Colding-Naber theory). Ideas which were first developed in this context have found numerous applications in other parts of mathematics - from the closely related theories of minimal surfaces and geometric flows, to the more distant theoretical computer science and geometric group theory.

We will explore the relations between the analysis on and the geometry of such manifolds, will obtain structural results (both global and local) on such spaces, and will develop a regularity theory for limit spaces.

<u>Course/Module aims:</u>

<u>Learning outcomes - On successful completion of this module, students should be able to:</u>
At the end of the class, students will be able to begin to read current papers in the field.

<u>Attendance requirements(%):</u>

Teaching arrangement and method of instruction:

<u>Course/Module Content:</u>
1. Revisit of Riemannain geometry and terminology: Second order analysis, distacnce functions and curvature.
2. Laplacian (mean curvature) comparison, volume comparison and rigidity.
3. Super harmonic functions in the support sense and their minimum principle.
4. The splitting theorem.
5. Gromov Hausdorff and Cheeger Gromov limits. compactness.
6. The harmonic radius, the curvature scale and epsilon regularity theorems.
7. Poincare inequality, Cheng-Yau gradient estimate, and Li-Yau Harnack inequality.
8. Green functions, heat kernel estimates and quantitative maximum principles.
9. Almost splitting and almost volume rigidity.
10. Tangents cones, stratification and quantitative stratification .
11. Regularity of non-collapsed lower Ricci limit spaces.

12. Cheerer-Naber resolution of the co-dimension 4 conjecture (the Einstein case).

Required Reading:
none

Additional Reading Material:
1. Petersen - Riemannian Geometry
2. Cheeger - Degeneration of Riemannain metrics under Ricci curvature bounds
3. Schoen and Yau - Lectures on differential geometry

Course/Module evaluation:
End of year written/oral examination 0 %
Presentation 0 %
Participation in Tutorials 0 %
Project work 0 %
Assignments 100 %
Reports 0 %
Research project 0 %
Quizzes 0 %
Other 0 %

Additional information: