Obuda University John von Neumann Faculty of Informatics	**Institute of Applied Mathematics**
Name and code: NAMGI1PMNE *Geometric inequalities: from flat to curved spaces*	**Credits*:*** *2020/21 year II. semester*
Subject lecturers: Prof. dr. habil. Alexandru Kristály	
Prerequisites (with code):	Calculus I&II; basic differential geometry

Weekly hours:	Lecture:	Seminar.:	Lab. hours:	Consultation:
Way of assessment:				

Course description:

Goal: To provide an insight into the theory of geometric inequalities on flat and curved settings

Course description: Several mathematical problem can be reduced to the study of geometric inequalities where the curvature of the space plays a crucial role. During the course we provide a quite complete picture about this theory, showing both theoretical aspects and specific applications by using optimal mass transport arguments, symmetrisation, etc.

Lecture schedule

Education week	*Topic*
1.	Brunn-Minkowski inequalities
2.	Isoperimetric inequalities
3.	Monge-Ampere equation and Kantorovich duality
4.	Borell-Brascamp-Lieb-type inequalities: flat case
5.	Distortion coefficients
6.	Borell-Brascamp-Lieb-type inequalities: curved case
7.	Equality cases in Borell-Brascamp-Lieb-type inequalities
8.	CD(K,N) inequalities of Lott-Sturm-Villani
9.	Heisenberg groups: failure of CD(K,N)
10.	Borell-Brascamp-Lieb-type inequalities on Heisenberg groups
11.	Busemann and Aleksandrov-type inequalities on curved spaces
12.	Convexity notions on negatively curved spaces
13.	Geometric inequalities for first eigenvalues
14.	Open problems: geometric inequalities

Midterm requirements

Education week	*Topic*

Final grade calculation methods

Achieved result	Grade
89%-100%	excellent (5)
76%-88<%	good (4)
63%-75<%	average (3)
51%-62<%	satisfactory (2)
0%-50<%	failed (1)

Type of exam

Project presentation & Written exam

Type of replacement

Project presentation

References

Mandatory:

1. Kristály A., Radulescu V., Varga Cs., *Variational Principles in Mathematical Physics, Geometry, and Economics*, Cambridge University Press, Enciclopedia of Mathematics and its Applications. No 136, 2010.
2. Balogh Z., Kristály A., Sipos K., Geometric inequalities on Heisenberg groups. *Calc. Var. Partial Differential Equations* 57 (2018), no. 2, Paper No. 61, 41 pp.
3. Villani C., *Optimal Transport*, Volume 338 of Grundlehren der Mathematischen Wissenschaften. Springer, Berlin (2009).

Recommended:

1. Balogh Z., Kristály A., Equality in Borell-Brascamp-Lieb inequalities on curved spaces. *Adv. Math.* 339 (2018), 453–494.
2. Colesanti A., Brunn-Minkowski inequalities for variational functionals and related problems. *Adv. Math.* 194 (2005), no. 1, 105–140.
3. Cordero-Erausquin D., McCann R.J., Schmuckenschläger M., A Riemannian interpolation inequality à la Borell, Brascamp and Lieb. *Invent. Math*. 146(2), 219–257 (2001).
4. Villani C., *Topics in Optimal Transportation*, Volume 58 of Graduate Studies in Mathematics. American Mathematical Society, Providence (2003).