English version

Topics on Kähler Geometry and Hodge Theory.

Level of course
Master Course

Semester/quarter
2nd semester (Spring 2024)

Hours per week
3 hours

Name of lecturer
Mario Garcia-Fernandez

Objectives of the course
This course will be an introduction to complex and Kähler geometry with emphasis on Hodge Theory and elliptic operator theory with a goal towards understanding Kodaira's characterization of complex algebraic manifolds.

Prerequisites
Basic Differential Geometry and Analysis.

Course contents
The course will cover the following topics:

1. Introduction to complex geometry: complex manifolds, vector bundles and connections, Chern classes.
2. Introduction to Kähler geometry.
3. Elliptic operator theory.
4. Hodge Theory.
5. Kodaira's Embedding Theorem.

Learning outcomes and competences
Relevant to the course subject matter the student should at the end of the

course be able to:

(a) reproduce key results and give rigorous and detailed proofs of them,

(b) compare key results,

(c) apply the basic techniques, results and concepts of the course to concrete examples and exercises,

(d) to study a prescribed topic on his own and give an oral presentation of selected parts of the topic for his fellow students with pertinent written notes,

(e) combine concepts from geometry, analysis and topology, and

(f) show how the course generalizes classical results.

Literature

D. Huybrechts, *Complex Geometry – An introduction*, Universitext, Springer (2005).

P. Gauduchon, *Extremal Kähler Metrics: an elementary introduction*, 2017, https://cims.nyu.edu/∼rodion/lib/P.%20Gauduchon.%20Calabi's%20extremal%20Kähler%20metrics:%20An%20elementary%20introduction%20-%202017.pdf.

G. Székelyhidi, *An Introduction to Extremal Kähler Metrics*, Graduate Studies in Mathematics **152**, AMS (2014).

C. Voisin, *Hodge Theory and Complex Algebraic Geometry I*, Cambridge Studies in Advanced Mathematics 76, Cambridge University Press (2002).

R.O. Wells, *Differential Analysis on Complex Manifolds*, GTM **65**, Springer-Verlag New York (2007).

Teaching methods
3 hours of lectures per week including exercises and oral presentations of the students

Language of instruction
English