Differential geometry II

Lecturer
Mélanie BERTELSON (Coordinator)

Course mnemonic
MATH-F420

ECTS credits
5 credits

Language(s) of instruction
English

Course period
First term

Campus
Plaine

Course content

Covering spaces and properly discontinuous group actions.
Distributions, Fröbenius' theorem and contact structures.
Existence of partitions of unity.
Differential forms and de Rham cohomology.
Integration and Stokes' theorem.
Classification of 2-manifolds via Morse theory (if time permits).

Objectives (and/or specific learning outcomes)

To introduce more advanced topics in differential geometry, such as foliations, differential forms, de Rham cohomoloy and prove the general version of Stokes' theorem.

Pre-requisits and co-requisits

Courses having this one as co-requisit

MATH-F413 | Géométrie riemannienne | 5 crédits, MATH-F417 | Groupes et algèbres de Lie | 5 crédits, MATH-F511 | Global analysis | 5 crédits, MATH-F512 | Géométrie symplectique | 5 crédits and MATH-F513 | Riemann surfaces | 5 crédits

Required knowledge and skills

To be able to follow this course, It is necessary to have passed a first course on differential geometry, such as MathF310, covering at least the notion of :

- intrinsic manifold
- smooth map between smooth manifolds
- tangent vector and tangent space at a point in a manifold.
- vector field and its flow.
- differential of a smooth map.

Teaching method and learning activities

Theoretical courses (24 hrs) taught in English and homeworks.

Contribution to the teaching profile

This course is about manifolds without additional structures and follows MathF310. It is co-requis of the following courses : Géométrie Riemannienne, Géométrie Symplectique, Riemann Surfaces, Global Analysis, Groupes et algèbres de Lie.

References, bibliography and recommended reading

1 Lee, Jeffrey. *Introduction to smooth manifolds.* Springer, Graduate texts in mathematics, 2003.

2 Bott, Raoul & Tu, Loring. *Differential forms in algebraic topology.* Springer, Graduate texts in mathematics, 1982.

3 Hirsch, Morris W. Differential topology. Corrected reprint of the 1976 original. Graduate Texts in Mathematics, 33. Springer-Verlag, New York, 1994.

4 Lang, Serge. Introduction to differentiable manifolds. Second edition. Universitext. Springer-Verlag, New York, 2002.

5 Milnor, John. Morse theory. Based on lecture notes by M. Spivak and R.Wells. Annals ofMathematics Studies, No. 51 Princeton University Press, Princeton, N.J. 1963.

6 Spivak, Michael, A comprehensive introduction to differential geometry. Vol. V. Second edition. Publish or Perish, Inc., Wilmington, Del., 1979.

7 Warner, Frank W.Foundations of differentiable manifolds and Lie groups. Corrected reprint of the 1971 edition. Graduate Texts in Mathematics, 94. Springer-Verlag, New York-Berlin, 1983.

8 Donaldson, Simon. Riemann surfaces, Oxford Gradaute Texts in Mathematics, 22. Oxford University Press, Oxford, 2011.

Course notes

Syllabus and Université virtuelle

Other information

Place(s) of teaching

Plaine

Contact(s)

Mélanie Bertelson (2.07.111) - Melanie.Bertelson@ulb.be - 02 650 58 28.

Evaluation method(s)

written examination and Personal work

written examination

Open question with short answer and Open question with developed answer

Evaluation method(s) (additional information)

Written exam and homeworks which contribute for 1/4th of the final grade.

Determination of the mark (including the weighting of partial marks)

Final note based on the note for the written exam N^e and the note for the homeworks N^h according to the rule : 3/4 N^e + 1/4 N^h.

Main language(s) of evaluation

English

Other language(s) of evaluation, if applicable

French

Programmes

Programmes proposing this course at the faculty of Sciences

MA-MATH | Master in Mathematics | finalité Research/unit 1 and finalité Research/unit 2