

MATH-475

Mathematical physiology

Lessinnes Thomas Olivier D.

Cursus	Sem.	Type
Ing.-math	MA1, MA3	Opt.
Mathematics for teaching	MA1, MA3	Opt.
Mathématicien	MA1, MA3	Opt.

Language of teaching	English
Credits	5
Session	Winter
Semester	Fall
Exam	Oral
Workload	150h
Weeks	14
Hours	4 weekly
Courses	2 weekly
Exercises	2 weekly
Number of positions	

Summary

The aim of the course is two fold: to bring students within reach of current research topics in physiology and to showcase methods allowing to analyse non-linear systems of differential equations.

Content

The course will derive and analyse models for

- enzyme kinematics
- trans-membrane ion transport
- wave propagation in neurones
- calcium dynamics
- the electrochemical action of the heart
- the heart as a pump
- respiration
- blood cell production

Keywords

Physiology; Non-linear dynamics

Learning Prerequisites**Required courses**

Analysis I-III

Recommended courses

Ordinary Differential Equations (MATH-301)

Learning Outcomes

- Derive models for physiological phenomena;
- Analyze these models;
- Infer practically relevant qualitative behaviours of complex systems.

Assessment methods

Oral exam

Dans le cas de l'art. 3 al. 5 du Règlement de section, l'enseignant décide de la forme de l'examen qu'il communique aux étudiants concernés.

Supervision

Office hours	Yes
Assistants	Yes
Forum	No

Resources

Bibliography

- [1] J. Keener and J. Sneyd, *Mathematical Physiology* (Springer-Verlag, 1998). First edition or Second edition Vol I: Chs. 2, 7. Vol II: Chs. 11, 13, 14. (Springer-Verlag, 2009)]
- [2] J. D. Murray, *Mathematical Biology* (Springer-Verlag, 2nd ed., 1993). [Third edition, Vols I and II, (Springer-Verlag, 2003).]
- [3] L. Glass and M. C. Mackey, *From Clocks to Chaos* (Princeton University Press, 1988).
- [4] P. Grindrod, *Patterns and Waves* (OUP, 1991).

Ressources en bibliothèque

- [\(electronic version vol.2\)](#)
- [Patterns and Waves / Grindrod](#)
- [From Clocks to Chaos / Glass & Mackey](#)
- [Mathematical Physiology / Keener & Sneyd](#)
- [Mathematical Biology, Murray](#)
- [\(electronic version vol.1\)](#)

Notes/Handbook

Will be provided as the year progresses.