UCLouvain

lmat1223

2022

Differential equations

5.00 credits	30.0 h + 15.0 h	Q2

Teacher(s)	Olbermann Heiner ;
Language :	French > English-friendly
Place of the course	Louvain-la-Neuve
Prerequisites	- either LMAT1121 Analyse mathématique 1, LMAT1122 Analyse mathématique 2 et LMAT1131 Algèbre linéaire - or LFSAB1102 Mathématiques 2
Main themes	Mathematical study, performed using algebraic and analytical methods, of some problems about ordinary differential equations and of the qualitative properties of their solutions.
Learning outcomes	**At the end of this learning unit, the student is able to :** **General learning outcomes.** **By the end of the course, the student should be able to:** 1) recognise and understand a basic foundation of mathematics. Choose and use the basic tools of calculation to solve mathematical problems. Recognise the fundamental concepts of important current mathematical theories. Establish the main connections between these theories, analyse them and explain them through the use of examples. 2) identify, by use of the abstract and experimental approach specific to the exact sciences, the unifying features of different situations and experiments in mathematics or in closely related fields (probability and statistics, physics, computing). 3) show evidence of abstract thinking and of a critical spirit. Argue within the context of the axiomatic method Recognise the key arguments and the structure of a proof. Construct and draw up a proof independently. Evaluate the rigour of a mathematical or logical argument and identify any possible flaws in it. Distinguish between the intuition and the validity of a result and the different levels of rigorous understanding of this same result. 4) be clear, precise and rigorous in communicating. Write a mathematical text in French according to the conventions of the discipline. **Specific learning outcomes.** **By the end of the course, the student should be able to :** - Construct mathematically solutions to differential equation problems. - Link properties of a linear map to the properties of solutions of a differential equation in which it appears. - Apply methods for systems of first-order differential equations to higher order differential equations. - Exploit relationships between solutions of a linear differential equation.. - Study the uniqueness of solutions for a differential equations with the help of counterexamples and proofs. - Caracterise topologically maximal solutions. - Determine whether a differential equaton problem admits a global solution. - Study the stability of an equilibrium. - Define stability. - Compare and link together definitions and criteria of stability with the help of proofs and counterexamples. - State, prove and apply existence and uniqueness criteri for boundary value problems. - Illustrate definitions and statements by examples and counterexamples.

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Evaluation methods	Learning will be assessed by a final examination. The questions will ask students to : - reproduce the subject matter, especially definitions, theorems, proofs, and examples - select and apply methods from the course to solve problems and exercises - adapt methods of demonstration from the course to new situations -summarise and compare topics and concepts. Assessment will focus on : - knowledge, understanding and application of the different mathematical methods and topics from the course - precision of calculations - rigour of arguments, proofs and reasons - quality of construction of answers.
Teaching methods	Teaching is divided into lectures and exercise sessions. The lectures aim to introduce and explain fundamental concepts, provide examples and elucidate connections with other courses. The exercise sessions aim to teach how to select and use calculation methods and how to write down proofs.
Content	- initial value problems for ordinary differential equations: existence, uniqueness and dependence on the initial data, - structure of solutions for linear equations, - introduction to stability theory
Inline resources	Lecture notes will be made available online via Moodle.
Bibliography	
Faculty or entity in charge	MATH

Programmes containing this learning unit (UE)

Program title	Acronym	Credits	Prerequisite	Learning outcomes
Additionnal module in Mathematics	APPMATH	5		
Minor in Mathematics	MINMATH	5		
Additionnal module in Physics	APPHYS	5		
Bachelor in Mathematics	MATH1BA	5		