Content

Course Code	Course Name	Semester	Theory	Practice	Lab	Credit	ECTS
ING208	Differential Equations	4	2	1	0	2.5	4

Prerequisites	
Admission Requirements	

Language of Instruction	French
Course Type	Compulsory
Course Level	Bachelor Degree
Objective	-Following the discovery of infinitesimal calculus by Newton and Leibniz in the 17th century, and its subsequent application in physics and mechanics, mathematicians and physicists began studying the solutions of differential equations. Today, nearly all scientific disciplines, from economics to modeling, make use of differential equations. In this context, the objectives of the course are as follows: • To show students that some equations, even simple ones, cannot be solved explicitly, and that in certain cases, even the very definition of a solution may be delicate. • To teach and demonstrate the affine structure of the set of solutions of a linear differential equation. • To train students in methods for solving linear differential equations and systems of linear differential equations. • To teach students how to carry out a qualitative analysis of certain differential equations.
Content	- • First-order linear differential equations: structure of the solution set; solution using the method of variation of constants; Cauchy problem and matching of solutions. • Solution of second-order homogeneous linear differential equations with constant coefficients. • Solution of second-order linear differential equations with constant coefficients: use of the variation of constants method and matching problems. • Solution of second-order linear differential equations with variable coefficients, including an adapted use of the variation of constants method. • Study of examples of nonlinear first-order differential equations. • Solution of linear differential systems with constant coefficients: variation of constants method and applications. • Analysis of equilibrium points of two-dimensional differential systems.
References	Equations différentielles, Cours et Exercices, Jean-Luc Raimbault, 2007 http://www.lpp.fr/IMG/pdf_EquaDiffS4.pdf

Theory Topics

Week	Weekly Contents
1	First-order linear differential equations: structure of the solution set and solution methods.
2	Solution of first-order linear differential equations using the method of variation of constants.
3	First-order linear differential equations: study of matching (patching) problems.
4	Solution of second-order homogeneous linear differential equations with constant coefficients.
5	Solution of second-order linear differential equations with constant coefficients using the method of variation of constants.
6	Second-order linear differential equations with constant coefficients: study of matching problems.
7	Solution of second-order linear differential equations with variable coefficients, including an adapted use of the variation of constants method.

Week	Weekly Contents
8	Midterm examination.
9	Study of examples of nonlinear first-order differential equations.
10	Solution of homogeneous linear differential systems with constant coefficients, with applications.
11	Solution of linear differential systems using the method of variation of constants.
12	Analysis of equilibrium points of two-equation differential systems.
13	Continued study of equilibrium points of two-equation differential systems.
14	Final examination