UCL Université catholique de Louvain

LMAT1161

2014-2015

Mécanique analytique 1

5.0 credits	22.5 h + 30.0 h	2q

Teacher(s) :	Haine Luc ; Hagendorf Christian ;
Language :	Français
Place of the course	Louvain-la-Neuve
Inline resources:	The syllabus of the course is available on the iCampus website (> http://icampus.uclouvain.be/). It provides the theoretical material as well as all problem sets for the exercise sessions with elements of solutions, and a detailed bibliography.
Prerequisites :	Calculus LMAT1121 and linear algebra LMAT1131. Language skills: French (written and spoken) at high school level.
Main themes :	Kinematics, dynamics, Galilean invariance and change of frames. General theorems. Systems with one degree of freedom and motion in a central field. Lagrange equations.
Aims :	Contribution of the course to learning outcomes in the Bachelor in Mathematics programme. By the end of this activity, students will have made progress in: - Recognize and understand a basic foundation of mathematics. In particular: -- 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. - 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. - Show evidence of abstract thinking and of a critical spirit. In particular: -- Recognise the key arguments and the structure of a proof. -- Distinguish between the intuition and the validity of a result and the different levels of rigorous understanding of this same result. Learning outcomes specific to the course. By the end of this activity, students will be able to: - Formulate a problem in analytical mechanics both in an inertial and non-inertial frame. - Use the fundamental theorems of mechanics. - Solve a problem with one degree of freedom, discuss the diagram of potential energy and the phase plane. Use the notion of effective potential. - Write the Lagrange equations of a system with several degrees of freedom. *The contribution of this Teaching Unit to the development and command of the skills and learning outcomes of the programme(s) can be accessed at the end of this sheet, in the section entitled "Programmes/courses offering this Teaching Unit".*
Evaluation methods :	Assessment is by means of a written examination relating to both theory and exercises, with a larger part for exercises. The examination tests knowledge and understanding of the concepts covered in the course, ability to analyse a problem in analytical mechanics through mathematical modelling, ability to construct and write a coherent argument, and mastery of the techniques of calculation. Active participation in exercise sessions may supply a bonus of a maximum of 2 points out of 20 which are added to the examination grade.
Teaching methods :	Learning activities consist of lectures and exercise sessions. Lectures aim to introduce the fundamental concepts and to explain them by giving examples and determining results, by showing their reciprocal connections and their connections with other courses in the programme for the Bachelor in Mathematics and Physics. Exercise sessions aim to teach how to model Physics problems, to select and use the methods of calculation to analyse them and to interpret the results obtained.
Content :	This course is the first part of a course in analytical mechanics which runs over the two first years of the Bachelor programme in Mathematics and Physics. Several modern mathematical theories owe their existence to problems in mechanics and only later have acquired a living on their own. The following subjects are treated in the course. - Newtonian mechanics: kinematics, dynamics, Galilean invariance and change of frame, general theorems. - Systems with one degree of freedom: definition of the problem, motions along a curve (simple pendulum, slide), analytical solution, discussion of the diagram of the potential (equilibriums, reflection points, periodic motions, non-periodic motions), phase plane. - Lagrangian mechanics: systems without and with constraints. - The two-body problem: definition of the problem, reduction of the problem to a system with one degree of freedom, analytical solution, Kepler problem.

Bibliography :	<!--{cke_protected}{C}%3C!%2D%2D%0A%20%2F*%20Font%20Definitions%20*%2F%0A%40font-face%0A%09%7Bfont-family%3A%22Cambria%20Math%22%3B%0A%09panose-1%3A2%204%205%203%205%204%206%203%202%204%3B%0A%09mso-font-charset%3A0%3B%0A%09mso-generic-font-family%3Aauto%3B%0A%09mso-font-pitch%3Avariable%3B%0A%09mso-font-signature%3A3%200%200%200%201%200%3B%7D%0A%40font-face%0A%09%7Bfont-family%3A%22%E3%83%92%E3%83%A9%E3%82%AE%E3%83%8E%E8%A7%92%E3%82%B4%20Pro%20W3%22%3B%0A%09mso-font-charset%3A0%3B%0A%09mso-generic-font-family%3Aroman%3B%0A%09mso-font-pitch%3Aauto%3B%0A%09mso-font-signature%3A0%200%200%200%200%200%3B%7D%0A%20%2F*%20Style%20Definitions%20*%2F%0Ap.MsoNormal%2C%20li.MsoNormal%2C%20div.MsoNormal%0A%09%7Bmso-style-update%3Aauto%3B%0A%09mso-style-unhide%3Ano%3B%0A%09mso-style-qformat%3Ayes%3B%0A%09mso-style-parent%3A%22%22%3B%0A%09margin%3A0cm%3B%0A%09margin-bottom%3A.0001pt%3B%0A%09mso-pagination%3Awidow-orphan%3B%0A%09font-size%3A12.0pt%3B%0A%09font-family%3A%22Times%20New%20Roman%22%3B%0A%09mso-fareast-font-family%3A%22Times%20New%20Roman%22%3B%0A%09mso-bidi-font-family%3A%22Times%20New%20Roman%22%3B%0A%09mso-ansi-language%3AEN-US%3B%0A%09mso-fareast-language%3AEN-US%3B%7D%0Ap.CorpsA%2C%20li.CorpsA%2C%20div.CorpsA%0A%09%7Bmso-style-name%3A%22Corps%20A%22%3B%0A%09mso-style-unhide%3Ano%3B%0A%09mso-style-parent%3A%22%22%3B%0A%09margin%3A0cm%3B%0A%09margin-bottom%3A.0001pt%3B%0A%09mso-pagination%3Awidow-orphan%3B%0A%09font-size%3A12.0pt%3B%0A%09mso-bidi-font-size%3A10.0pt%3B%0A%09font-family%3AHelvetica%3B%0A%09mso-fareast-font-family%3A%22%E3%83%92%E3%83%A9%E3%82%AE%E3%83%8E%E8%A7%92%E3%82%B4%20Pro%20W3%22%3B%0A%09mso-bidi-font-family%3A%22Times%20New%20Roman%22%3B%0A%09color%3Ablack%3B%0A%09mso-ansi-language%3AFR%3B%7D%0A.MsoChpDefault%0A%09%7Bmso-style-type%3Aexport-only%3B%0A%09mso-default-props%3Ayes%3B%0A%09font-size%3A10.0pt%3B%0A%09mso-ansi-font-size%3A10.0pt%3B%0A%09mso-bidi-font-size%3A10.0pt%3B%7D%0A%40page%20WordSection1%0A%09%7Bsize%3A612.0pt%20792.0pt%3B%0A%09margin%3A70.85pt%2070.85pt%2070.85pt%2070.85pt%3B%0A%09mso-header-margin%3A36.0pt%3B%0A%09mso-footer-margin%3A36.0pt%3B%0A%09mso-paper-source%3A0%3B%7D%0Adiv.WordSection1%0A%09%7Bpage%3AWordSection1%3B%7D%0A%2D%2D%3E--> Syllabus available on iCampus with bibliographical references.
Cycle and year of study :	> Bachelor in Mathematics > Bachelor in Physics
Faculty or entity in charge:	MATH