

# Analytical Mechanics

Programme course

6 credits

Analytisk mekanik

TFYA40

Valid from: 2017 Spring semester

**Determined by**

Board of Studies for Electrical  
Engineering, Physics and Mathematics

**Date determined**

2017-01-25

## Main field of study

Mathematics, Applied Mathematics, Applied Physics, Physics

## Course level

Second cycle

## Advancement level

A1X

## Course offered for

- Physics and Nanoscience, Master's Programme
- Physics and Nanotechnology
- Applied Physics and Electrical Engineering - International, M Sc in Engineering
- Applied Physics and Electrical Engineering, M Sc in Engineering
- Materials Science and Nanotechnology, Master's programme

## Entry requirements

Note: Admission requirements for non-programme students usually also include admission requirements for the programme and threshold requirements for progression within the programme, or corresponding.

## Prerequisites

Modern Physics, Mechanics

## Intended learning outcomes

The course represents the basic principles of classical mechanics within the framework of the variational approach. The knowledge of these principles is necessary for a deeper penetration into the structure of the classical mechanics itself, and also for a proper understanding of statistical mechanics, quantum mechanics etc. Furthermore, the methods of the analytical mechanics can serve as a set of the efficient tools for the solution of the majority of hard problems of mechanics and related topics.

To achieve this aim students should be able to

- formulate the Lagrangian function for different mechanical systems,
- solve and analyze Lagrange's equations of motion for the set of generalized coordinates,
- formulate the Hamiltonian function for different mechanical systems,
- solve Hamilton's equations of motion for the canonical variables,
- use the generating functions to make canonical transformations.

## Course content

The variational approach to mechanics, Hamilton's principle, Lagrange's equations, first integrals and conservation theorems, elimination of cyclic variables, small oscillations theory, central force problem, Hamiltonian formulation of mechanics, canonical transformations, Hamilton-Jacobi theory, Poisson bracket formulation, introduction to analytical mechanics of continuous systems.

## Teaching and working methods

Lectures and seminars with the solution of problems

## Examination

TEN1      Written Examination                      6 credits                      U, 3, 4, 5

## Grades

Four-grade scale, LiU, U, 3, 4, 5

## Other information

Supplementary courses: Quantum Mechanics can be followed in parallel, Quantum Dynamic

## Department

Institutionen för fysik, kemi och biologi

## Director of Studies or equivalent

Magnus Johansson

## Examiner

Iryna Yakymenko

## Course website and other links

<http://www.ifm.liu.se/undergrad/fysikgtu/coursepage.html?selection=all&sort=kk>

## Education components

Preliminary scheduled hours: 56 h

Recommended self-study hours: 104 h

## Course literature

### Additional literature

#### Books

H. Goldstein, Ch. Poole, J. Safko, (2001) *Classical Mechanics 3*  
(selected parts). Addison & Wesley

#### Compendia

I.I. Yakymenko, Lecture Notes in Analytical Mechanics  
I.I. Yakymenko, Set of Problems in Analytical Mechanics

## Common rules

Regulations (apply to LiU in its entirety)

The university is a government agency whose operations are regulated by legislation and ordinances, which include the Higher Education Act and the Higher Education Ordinance. In addition to legislation and ordinances, operations are subject to several policy documents. The Linköping University rule book collects currently valid decisions of a regulatory nature taken by the university board, the vice-chancellor and faculty/department boards.

LiU's rule book for education at first-cycle and second-cycle levels is available at [http://stydokument.liu.se/Regelsamling/Innehall/Utbildning\\_pa\\_grund-\\_och\\_avancerad\\_niva](http://stydokument.liu.se/Regelsamling/Innehall/Utbildning_pa_grund-_och_avancerad_niva).