

# COURSE DETAIL

## ANALYTICAL MECHANICS

**Country**

Germany

**Host Institution**

Free University of Berlin

**Program(s)**

Free University Berlin

**UCEAP Course Level**

Upper Division

**UCEAP Subject Area(s)**

Physics

**UCEAP Course Number**

111

**UCEAP Course Suffix****UCEAP Official Title**

ANALYTICAL MECHANICS

**UCEAP Transcript Title**

ANALYTICAL MECHANICS

**UCEAP Quarter Units**

8.50

**UCEAP Semester Units**

5.70

## Course Description

This course, comprised of a lecture and discussion section, includes the following topics: 1) Introduction (historical notes, coordinate dependence of Newton's equations, systems with constraints); 2) Lagrange equations (systems w/o constraints, non-inertial reference frames, constraints and generalized coordinates, virtual displacements, D'Alembert's principle, systems w/ constraints); 3) Hamilton's principle (variational calculus, derivation of Lagrange equations from Hamilton's principle, Lagrange multipliers and constraints); 4) Symmetries and conservation laws (cyclic coordinates and canonical momenta, translational and rotational invariance, Noether theorem, translational invariance in time and energy conservation, energy conservation in 1D systems, Galilei invariance and Lagrangian of free particles, relativistic mechanics of free particles, gauge invariance, mechanical similarity); 5) Oscillations (coupled oscillators, driven oscillators, Green function of damped oscillator, parametric resonance, motion in rapidly oscillating fields); 6) Rigid bodies (degrees of freedom, tensor of inertia and kinetic energy, angular momentum, principal axes of tensor of inertia, equations of motion, Euler angles, free symmetric top, heavy symmetric top, fast top).

## Language(s) of Instruction

German

## Host Institution Course Number

20113401

## Host Institution Course Title

ANALYTISCHE MECHANIK

## Host Institution Course Details

[https://www.physik.fu-berlin.de/en/einrichtungen/ag/ag-von-  
oppen/teaching/AnaIM...](https://www.physik.fu-berlin.de/en/einrichtungen/ag/ag-von-oppen/teaching/AnaIM...)

## Host Institution Campus

## Host Institution Faculty

**Host Institution Degree**

**Host Institution Department**

Physik

**Course Last Reviewed**

2024-2025

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