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| Module title | | Abbreviation |
| Classical Physics 1 (Mechanics) | | 11-E-M-152-m01 |
| Module coordinator | | Module offered by |
| Managing Director of the Institute of Applied Physics | | Faculty of Physics and Astronomy |
| ECTS | Method of grading | Only after succ. compl. of module(s) |
| 8 | numerical grade | -- |
| Duration | Module level | Other prerequisites |
| 1 semester | undergraduate | Admission prerequisite to assessment: completion of exercises (approx. 13 exercise sheets per semester). Students who successfully completed approx. 50% of exercises will qualify for admission to assessment. The lecturer will inform students about the respective details at the beginning of the semester. |
| Contents | | |
| <ol style="list-style-type: none"> 1. Principles: Physical quantities, prefactors, derived quantities, dimensional analysis, time / length / mass (definition, measurement procedures, SI), importance of metrology; 2. Point Mechanics: Kinematics, motion in 2D and 3D / vectors, special cases: Uniform and constant accelerated motion, free fall, slant litter; circular motion in polar coordinates; 3. Newton's laws: Forces and momentum definition, weight vs. mass forces on the pendulum, forces on an atomic scale, isotropic and anisotropic friction. Preparation of the equations of motion and solutions; 4. Work and energy: (Kinetic) performance, examples; 5. Elastic, inelastic and super-elastic collision: Energy and momentum conservation, surges in centre of mass and balance system, rocket equation; 6. Conservative and non-conservative force fields: Potential, potential energy; law, weight scale, field strength and potential of gravity (general relations); 7. Rotational motion: Angular momentum, angular velocity, torque, rotational energy, moment of inertia, analogies to linear translation, applications, satellites (geostationary and interstellar), escape velocities, trajectories in the central potential; 8. Tidal forces: Inertial system, reference systems, apparent forces, Foucault pendulum, Coriolis force, centrifugal force; 9. Galilean transformation: Brief digression to Maxwell's equations, ether, Michelson interferometer, Einstein's postulates, problem of simultaneity, Lorentz transformation, time dilation and length contraction, relativistic impulse; 10. Rigid body and gyroscope: Determining the centre of mass, inertia tensor and -ellipsoid, principal axes and their stability, tensor on the example of the elasticity tensor, physics of the bike; gyroscope: Precession and nutation, the Earth as a spinning top; 11. Friction: Static and dynamic friction, stick-slip motion, rolling friction, viscous friction, laminar flow, eddy formation; 12. Vibration: Representation by means of complex e-function, equation of motion (DGL) on forces, torque and power approach, Taylor expansion, harmonic approximation; spring and pendulum, physical pendulum, damped vibration (resonant case, Kriechfall, aperiodic limit), forced vibration, Fourier analysis; 13. Coupled vibrations: Eigenvalues and eigenfunctions, double pendulum, deterministic vs. chaotic motion, non-linear dynamics and chaos; 14. Waves: Wave equation, transverse and longitudinal waves, polarisation, principle of superposition, reflection at the open and closed end, speed of sound; interference, Doppler effect; phase and group velocity, dispersion relation; 15. Elastic deformation of solid bodies: Elastic modulus, general Hooke's law, elastic waves; 16. Fluids: Hydrostatic pressure and buoyancy, surface tension and contact angle, capillary forces, steady flows, Bernoulli equation; Boyle-Mariotte, gas laws, barometric height formula, air pressure, compressibility and compressive modulus; 17. Kinetic theory of gases: ideal and real gas, averages, distribution functions, equipartition theorem, Brownian motion, collision cross section, mean free path, diffusion and osmosis, degrees of freedom, specific heat | | |

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| Intended learning outcomes |
| The students understand the basic contexts and principles of mechanics, vibration, waves and kinetic theory of gases. They are able to apply mathematical methods to the formulation of physical contexts and autonomously apply their knowledge to the solution of mathematical-physical tasks. |
| Courses (type, number of weekly contact hours, language — if other than German) |
| V (4) + Ü (2) Module taught in: Ü: German or English |
| Method of assessment (type, scope, language — if other than German, examination offered — if not every semester, information on whether module is creditable for bonus) |
| written examination (approx. 120 minutes) Language of assessment: German and/or English |
| Allocation of places |
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| Additional information |
| Registration: If a student registers for the exercises and obtains the qualification for admission to assessment, this will be considered a declaration of will to seek admission to assessment pursuant to Section 20 Subsection 3 Sentence 4 ASPO (general academic and examination regulations). If the module coordinators subsequently find that the student has obtained the qualification for admission to assessment, they will put the student's registration for assessment into effect. Only those students that meet the respective prerequisites can successfully register for an assessment. Students who did not register for an assessment or whose registration for an assessment was not put into effect will not be admitted to the respective assessment. If a student takes an assessment to which he/she has not been admitted, the grade achieved in this assessment will not be considered. |
| Workload |
| 240 h |
| Teaching cycle |
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| Referred to in LPO I (examination regulations for teaching-degree programmes) |
| § 53 I Nr. 1 a) § 77 I Nr. 1 a) |
| Module appears in |
| Bachelor's degree (1 major) Physics (2015) Bachelor's degree (1 major) Nanostructure Technology (2015) Bachelor's degree (1 major) Mathematical Physics (2015) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2015) First state examination for the teaching degree Grundschule Physics (2015) First state examination for the teaching degree Realschule Physics (2015) First state examination for the teaching degree Gymnasium Physics (2015) First state examination for the teaching degree Mittelschule Physics (2015) Bachelor's degree (1 major) Mathematical Physics (2016) First state examination for the teaching degree Grundschule Physics (2018) First state examination for the teaching degree Realschule Physics (2018) First state examination for the teaching degree Gymnasium Physics (2018) First state examination for the teaching degree Mittelschule Physics (2018) Bachelor's degree (1 major) Physics (2020) Bachelor's degree (1 major) Nanostructure Technology (2020) Bachelor's degree (1 major) Mathematical Physics (2020) Bachelor's degree (1 major, 1 minor) Physics (Minor, 2020) First state examination for the teaching degree Grundschule Physics (2020) First state examination for the teaching degree Gymnasium Physics (2020) First state examination for the teaching degree Realschule Physics (2020) |

First state examination for the teaching degree Mittelschule Physics (2020)
Bachelor's degree (1 major) Functional Materials (2021)
Bachelor's degree (1 major) Quantum Technology (2021)
exchange program Physics (2023)
Bachelor's degree (1 major) Mathematical Physics (2024)
Bachelor's degree (1 major) Functional Materials (2025)