12998-224(16) Classical Mechanics (3L, 3P)

2019

Course summary:

Velocity-dependent non-conservative force, conservative systems in three-dimensional space, central force motion, planetary and satellite motion, scattering of particles, multi-particle systems, dynamics of rigid bodies, geometrical optics, free and forced linear oscillations with damping, one-dimensional wave motion with boundary conditions, Doppler effect, interference and diffraction, physical optics.

Method of assessment: Flexible assessment

Prerequisite pass modules: Physics 114, 144
Prerequisite modules: Mathematics 114, 144

Language policy:

Afrikaans and English in the same class groups:
In the first 10 weeks: During each lecture, all information is conveyed at least in English. Summaries and/or explanation of the core concepts will also be given in Afrikaans. Questions in Afrikaans and English will, at the least be answered in the language of the question. Students will be supported in Afrikaans and English during a combination of appropriate facilitated learning opportunities. The final weeks of the module are offered in English, students will receive support in Afrikaans upon appointment with Kristian Müller-Nedebock.

Module relevance in programme:

Mechanics as presented in the first year is considered in a more generalised form shifting the emphasis to understanding symmetries and conservation laws. This is closely related to expressing physics laws through extremum principles. Along the way we spend time investigating the harmonic and inverse-square force systems, that are foundations for many calculations in physics. A second goal is to deepend the mathematics and basic concepts of oscillatory systems and their modes. This prepares students for the material to be covered in the second semester, Physics 254.

Outcomes of course:

Students are introduced to more advanced concepts in Newtonian classical mechanics. Students will be expected to gain abilities in calculations on these systems as well as in the conceptual understanding of the physics.

Lecturer:

Prof KK Müller-Nedebock: Mechanics
Tel: (021) 808-3386 E-mail: kkmn@sun.ac.za
Office: Room 1027 in the Merensky Physics Building

Prof. H. Weigel: Oscillations
Tel: (021) 808-3378 E-mail: weigel@sun.ac.za
Office: Room 1026 in the Merensky Physics Building.

Mentor:

For each year of our physics programme the Department of Physics has appointed a staff member as mentor to be available to students. You are always invited to discuss general issues in the physics

programme or its modules with this mentor, in addition to usual consultations with your individual lecturers.

For this module your mentor is **Dr** GW Bosman gwb@sun.ac.za

Course content:

Mechanics
Conservative forces and conservation laws within the Lagrangian formulation of dynamics. Applications to classical systems with gravity. Nonconservative, velocity-dependent forces.

Oscillations
1. Free oscillations of simple systems
2. Harmonically forced oscillations
3. Free oscillations of systems with many degrees of freedom

Practicals& Tutorials:

Experiments and tutorials will expand upon and complement the lectures. Experiments may include: Studies of forced and damped oscillator, elastic and inelastic collisions, determination of the velocity of light, simple spectroscopic investigations as well as investigations of standing waves. The experimental part of this module is integral to the course. Both the active participation during practicals as well as subsequent reports will be assigned a mark.

Study material:

Prescribed textbook: “A Student's Guide to Analytical Mechanics” by J.L. Bohn, Cambridge University Press, 2018

Assessment:

Methods of Assessments
Continuous Assessment

Mechanics Section (First ten weeks): The continuous assessment includes multiple **assignments**, **problem-solving sessions**, and at least 2 **practical essay**s, as well as a mid-semester test and a final test.
Oscillations (Final 4 weeks) The continuous assessment includes **homework**, **tests**, **tutorial tests** and **practical reports** and the final test.

Venue and time of assessment opportunities
See ***timetable*** on Physics home page as well as official University webpage

Availability of marks:
Papers, assignment and feedback are returned as soon as possible.

Calculation of final mark for the module:
The final mark will be calculated as follows:

Tests: 50%; Assignments and practical reports: 50%.