12998-224(16) Classical Mechanics, Waves and Optics (3ℓ, 3p)

2016

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.

Continuous assessment

PP Physics 114
P Mathematics 114, 144
PP Physics 144

Outcomes of course:

Students are introduced to more advanced concepts in Newtonian classical mechanics. Students are introduced to concepts regarding wave phenomena in various facets of Physics, with emphasis on applications in Optics. Students will be expected to gain abilities in calculations on these systems as well as in the conceptual understanding of the physics.

Lecturer:

Prof BIS van der Ventel: Mechanics
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Office: Room 1019 in the Merensky Physics Building

Dr JN Kriel: Waves & Optics
Tel: (021) 808-3658 E-mail: hkriel@sun.ac.za
Office: Room 1014 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 PH Neethling pietern@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.

Waves & Optics
1. Free oscillations of simple systems
2. Harmonically forced oscillations
3. Free oscillations of systems with many degrees of freedom
4. One dimensional wave motion
5. Interference and diffraction
6. Interference by division of amplitude

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: "Mechanics" (3rd edition) by LD Landau and E.M Lifshitz, Elsevier
Class notes based on: ***"Waves and Optics"*** Berkeley Physics Course Vol. 3, and ***"Vibrations and Waves"*** by A.P. French were given to the students,
Prescribed textbook: **Vibrations and Waves by George C. King**

Assessment:

Methods of Assessments
Continuous Assessment

Mechanics Section (First term): The continuous assessment includes multiple in-class **assignments**, **problem-solving sessions**, and at least 1 **practical essay** as well as a short examination taken **orally**

Waves and Optics Section (Second term): The continuous assessment includes **homework**, **tests**, **tutorial tests** and **practical reports**.

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:

Mechanics:
For ½ of final module mark; made up as follows: 4 assessments (25% each).

Waves and Optics:
For ½ of final module mark; made up as follows: tests and tutorial tests 2/5, homework 2/5, practical 1/5