13005-134(16) Introductory Physics for Biological Sciences A (3l, 3p)

2017

Course summary:

Selected topics, relevant to the biological sciences, from introductory mechanics, hydro-statics and optics.

Method of assessment: Flexible assessment
Co-requisite module: Mathematics (Bio) 124 or Mathematics 114

Language policy:

Afrikaans or English in separate class groups (Parallel medium):
A class is divided into separate Afrikaans and English groups. Students provide their preferred language of teaching at registration. Additional learning opportunities involving students from both language groups will be used to promote integration.

Module relevance in programme:

The Physics (Bio) 134 module along with the Physics (Bio) 154 module forms part of a one year introductory Physics course aimed at students following programmes mainly in the Biological Sciences, but also Earth Science and Geoinformatics.

Suitable topics, including measurement and uncertainty, introductory mechanics, work and energy, hydrostatics and geometric optics, have been chosen to provide students with the tools and the understanding of basic physics and its principles, as well as scientific reasoning and data evaluation skills.

These physics principles contribute to the skills foundation of the larger Biological Science programmes and underpin many biophysical methods used in applications such as forensic science, imaging and sensing, and treatment modalities.

Outcomes of course:

The student will be:

- able to correctly use the terminology associated with the subject.
- equipped with problem-solving skills that can be applied within the subject.
- able to integrate concepts thereby making the topic relevant and applicable.
- given the opportunity to develop his/her writing, language and communication skills.
- able to perform plausible experiments.
- able to apply the scientific method to obtain data, which can be analysed mathematically.

Lecturers:

Dr JJ van Zyl (Eng)
Telephone number: (021) 808-3384
Email address: jjvz@sun.ac.za
Office: Room 1016 in the Merensky Physics Building.

Prof SM Wyngaardt (Afr)
Telephone number: (021) 808-3379 / 91

E-mail address: shaunmw@sun.ac.za
Office: Room 1018 in the Merensky Building

Dr TD Bucher
E-mail address: tdbucher@sun.ac.za

Dr O Shirinda
E-mail address: oshirinda@sun.ac.za

Mentor:

The Department of Physics has appointed a staff member as mentor for each year of its physics programme to be available to students for consultation. Students should feel free to discuss general issues related to the physics programme or specific modules in the programme with the relevant mentor, in addition to usual consultations with their individual lecturers of modules.

For this module your mentor is Prof RT Newman RTNewman@sun.ac.za

Course content:

1. Introduction and definitions (3 h)
- The nature of physics
- Physics and its relation to other fields
- Models, theories, and laws
- Measurement and uncertainty: Significant figures
- Units
- Converting units
- Order of magnitude

2. Dynamics (7 h)
- Vectors
- Force
- Newton's first law
- Mass
- Newton's second law
- Newton's third law
- Weight and the normal force
- Solving problems with Newton’s laws
- Problems involving friction, inclines
- Problem solving

3. Circular motion (3 h)
- Kinematics of uniform circular motion
- Dynamics of uniform circular motion
- Newton's law of universal gravitation

4. Work and energy (4 h)
- Work done by a constant force
- Work done by a varying force
- Kinetic energy and the work-energy principle
- Potential energy
- Conservative forces and non-conservative forces
- Mechanical energy and its conservation
- Problem solving

- Conservation of energy
- Energy conservation with dissipative forces
- Power

5. Linear momentum (2 h)
- Momentum and its relation to force
- Conservation of momentum
- Collisions and impulse
- Conservation of energy and momentum in collisions
- Elastic collision in one dimension
- Inelastic collisions

6. Rotation and Equilibrium
- Torque
- The conditions for equilibrium
- Solving static problems
- Applications to muscles and joints

7. Fluids (6 h)
- Density
- Pressure in fluids
- Atmospheric pressure and gauge pressure
- Pascal's principle
- Measurement of pressure
- Archimedes' principle

8. Geometric optics (6 h)
- The ray model of light
- Reflection: image formation by a plane mirror
- Reflection: images by spherical mirrors
- Index of refraction
- Refraction: Snell's law
- Total internal reflection
- Thin lenses: ray-tracing
- The thin lens equation and magnification
- Combinations of lenses.

9. Optical instruments. (5 h)
- The human eye: corrective lenses
- Compound microscope

Practical (Tutorials):

The practical part of the course consists of three experiments. Self-study is an important part of the practical. Material regarding the practicals is available electronically, which gives students the opportunity to familiarize themselves with the apparatus beforehand. Practical and tutorial schedules will be handed out in class and will be available on SUNLearn at the start of the semester.

Study material:

Giambattista, Physics, 3rd edition PLUS the McGraw-Hill Connect and Learnsmart digital products.

Note that the purchasing of access to the Connect/Learnsmart digital products are strongly encouraged as (i) the lecturer may assign homework through it, and (ii) the software provides a valuable learning tool to help master the necessary skills and concepts required in Physics.
(The Connect/Learnsmart code will be shrink-wrapped with the printed book for access to the Connect and Learnsmart products, and available from bookstores. For those students who choose not to purchase the printed book, they will still need to purchase the Connect code from the bookstores.)

Learning opportunities:

1. Regular tutorials
2. A selection of practical laboratory experiments related to the subjects covered in class.
3. Connect and Learnsmart software that accompany the prescribed textbook are available on the internet. The software will provide regular self-assessment opportunities to help students to continually asses their understanding of the subject.

Lecture Hall Room number Level

Lecture halls available on MyMaties.

All practicals and tutorials are in the **Merensky Building** for Physics. The practical and Tutorial schedule and venues will be handed out at the beginning of the year, and made available on the module page on SUNLearn.

Assessment:

Methods of Assessments

Class tests
Tutorial tests
Practical reports and practical tests

Venue and time of assessment opportunities
Available on MyMaties.

Calculation of class mark:
No class mark. An adequate final mark must be accumulated throughout the semester.

Calculation of final mark for the module:
Class tests: 60%
Tutorial tests: 25%
Practicals: 15%

Admission to examination:
This is a continuous assessment module where no exam is written.