# 12998-134(16) Introductory Physics for Biological Sciences A (3l, 3p)

# 2014

## Course summary:

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

*C Mathematics (Bio) 124 or C Mathematics 114*

## Outcomes of course:

**The student will be:**
1. able to correctly use the terminology associated with the subject.
2. equipped with problem-solving skills that can be applied within the subject.
3. able to integrate concepts thereby making the topic relevant and applicable.
4. given the opportunity to develop his/her writing, language and communication skills.
5. able to perform plausible experiments.
6. able to apply the scientific method to obtain data, which can be analyzed 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.

Dr A Stander (Afr)
Telephone number: (021) 808-3373
Email address: jas@sun.ac.za
Office: Room 1046 in the Merensky Physics Building.

## Course content:

**1. Introduction and definitions. (Giancoli Chapter 1)**
1.1. The nature of physics
1.2. Physics and its relation to other fields
1.3. Models, theories, and laws
1.4. Measurement and uncertainty: Significant figures
1.5. Units
1.6. Converting units
1.7. Order of magnitude

**2. Kinematics in one dimension. (Giancoli Chapter 2)**
2.2. Average velocity
2.3. Instantaneous velocity
2.4. Acceleration
2.7. Falling objects

**3. Dynamics. (Giancoli Chapter 4)**
3.1. Force
3.2. Newton's first law
3.3. Mass
3.4. Newton's second law
3.5. Newton's third law

3.6. Weight and the normal force
3.7. Solving problems with Newton’s laws
3.8. Problems involving friction, inclines
3.9. Problem solving

**4. Circular motion. (Giancoli Chapter 5)**
4.1. Kinematics of uniform circular motion
4.2. Dynamics of uniform circular motion
4.3. Newton's law of universal gravitation

**5. Work and energy. (Giancoli Chapter 6)**
5.1. Work done by a constant force
5.2. Work done by a varying force
5.3. Kinetic energy and the work-energy principle
5.4. Potential energy
5.5. Conservative forces and non-conservative forces
5.6. Mechanical energy and its conservation
5.7. Problem solving
5.8. Conservation of energy
5.9. Energy conservation with dissipative forces
5.10 Power

**6. Linear momentum. (Giancoli Chapter 7)**
6.1. Momentum and its relation to force
6.2. Conservation of momentum
6.3. Collisions and impulse
6.4. Conservation of energy and momentum in collisions
6.5. Elastic collision in one dimension
6.6. Inelastic collisions

**7. Rotation. (Giancoli Chapter 8)**
7.1. Torque

**8. Equilibrium. (Giancoli Chapter 9)**
8.1. The conditions for equilibrium
8.2. Solving static problems
8.3. Applications to muscles and joints

**9. Fluids. (Giancoli Chapter 10)**
9.1. Density
9.2. Pressure in fluids
9.3. Atmospheric pressure and gauge pressure
9.4. Pascal's principle
9.5. Measurement of pressure
9.6. Archimedes' principle
9.7. Fluids in motion: Flow rate and the equation of continuity
9.8. Bernoulli's equation
9.9. Applications of Bernoulli's principle

**18. Geometric optics. (Giancoli Chapter 23)**
18.1. The ray model of light
18.2. Reflection: image formation by a plane mirror
18.3. Reflection: images by spherical mirrors
18.4. Index of refraction
18.5. Refraction: Snell's law
18.6. Total internal reflection
18.7. Thin lenses: ray-tracing
18.8. The thin lens equation and magnification
18.9. Combinations of lenses.

**19. Optical instruments. (Giancoli Chapter 25)**

19.1. The human eye: corrective lenses
19.2. 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 Webstudies at the start of the semester.

## Study material:

Handbook: **Physics** - *Giancoli - 6th edition* - **Prentice Hall**
Software that is available via the intranet and on CD.

## Learning opportunities:

1. Tutorials
2. Software that is available on the intranet to assist students with their problem solving techniques.
3. Test and practice examples (with feedback) are available on the intranet to enable students to assess their understanding of the subject.

## Lecture Hall Room number Level

**Alpha (Afrikaans):** 0067, Ground floor
**De Beers Building for Chemistry(English): 2011**
All practicals and tutorials are in the **Merensky Building** for Physics.

## Assessment:

***Methods of Assessments***

2. Class tests
3. Practical reports and practical tests (continuous evaluation)
4. Examination

***Venue and time of assessment opportunities***
Available on MyMaties.

***Calculation of class mark:***
Class tests: 12%
Practical mark: 22%
Term test 1 and 2: 26% and 40% respectively

***Calculation of final mark for the module:***
Examination mark: 60%
Class mark: 40%

***Admission to examination:***
A class mark of at least 40% should be attained in order to qualify for the exam.