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**Student Hours**  
10:00 -11:00 am, Monday  
11:00 am – 1:00 pm,  
Tuesday

**Class Time & Location**

Tuesday: 9:30 – 10:20 am  
Thursday: 8:30 – 9:20 am  
Friday: 10:30 – 11:20 am

**Location:** MULH 2034  
(Tuesday and Thursday)  
KC1018A (Friday)

**Labs and Tutorials**  
Wednesday & Thursday:  
2:30 – 5:15pm  
**Labs:** PS 1012: starts on  
January 10, 2024  
**Tutorials:** PS 3046: starts  
on January 17, 2024

\*Labs are in every second  
week, alternating with  
tutorials!  
\* **Jamie Powell** is the  
primary contact for the  
Lab Section



ST. FRANCIS XAVIER  
UNIVERSITY

**Subject Name: Phys 102, Winter 2024**

Physics for the Life and Health Sciences II

**Course Overview**

Physics (PHYS) 102 is an introductory algebra-based course aimed at students in the life and health sciences. This course covered thermodynamics, Oscillation and waves, optics, and an overview of electricity and magnetism. Previous physics experience would be an asset but is not required. This is three credits and a lab course.

The experimental lab is a significant part of this course, and students must attend all the labs and actively perform each experiment. **Jamie Powell** ([jpowell@stfx.ca](mailto:jpowell@stfx.ca)) is the primary contact for the lab section. Lab announcement and lab material will be available on the “Moodle Page” <https://moodle.stfx.ca/course/view.php?id=34604>. Tutorials are mandatory and take place on the same day of your lab week but the alternate week.

**N. B.:** I strongly suggest students understand the lab procedure and mark scheme from *Jamie Powell* in the first lab!

**Additional Course Information**

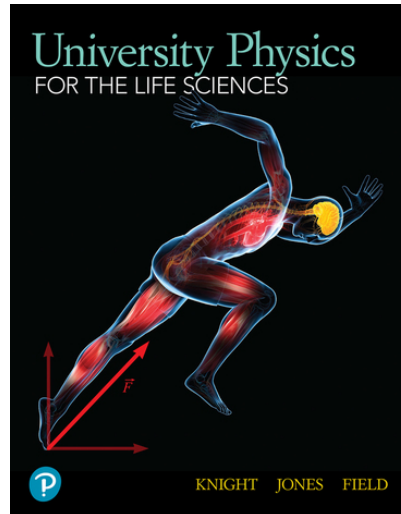
Class participation, textbook consultation, doing assignments, and participating in-class quizzes are the key to success in this course. Class attendance is strongly recommended, and students are responsible for collecting information from the classes.

**Learning Objectives**

By the end of this course, students will be able to:

- Explain the phenomenon of thermodynamics, oscillations and waves, and optics.
- Demonstrate electric charge and their influence on electricity and magnetism.
- Be skilled in problem-solving on above mention topics.

Textbook: University Physics – for the life sciences (first edition) by Knight, Jones, and Field



\*\* Textbook is available in the StFX bookstore.

Course webpage: <https://moodle.stfx.ca/course/view.php?id=33622>

Online classroom (if required): <https://ca-lti.bbcollab.com/collab/ui/scheduler/session>

Mastering Physics: Students are required to have mastering physics (MP) access code for assignments and learning catalytics!

Website: <https://mlm.pearson.com/northamerica/masteringphysics/>

Register as student

The Course ID: ahmed27981

The Course Title: Physics for the Life and Health Sciences II (Phys 102)

Book: University Physics – for the Life Sciences (first edition(1e))

Register as soon as possible. The first assignment will be given in the second week of classes!

Continuing Students: For any troubles with MP access, contact **Jeremy Guimond** directly at ([Jeremy.Guimond@PearsonEd.com](mailto:Jeremy.Guimond@PearsonEd.com)). Do not buy the new code!

\*\* New students must buy the book and MP code!

### Course Evaluation

Class attendance is highly recommended, and students are responsible for collecting information from the classes. The mark scheme will be:

Category	Marks
In-class activities (learning catalytics, tutorial attendance etc.)	5%
Assignments (5)	15%
Quizzes (3)	12%
Labs	15%
Midterm	15%
Final	38%
Total	100%

### Lab Grading Policy:

If you fail to provide complete lab notebook work for any one experiment, your lab grade will be reduced by 20 percentage points.

If you fail to provide complete lab notebook work for any two experiments, you will receive a zero for the lab portion of the course, regardless of your performance on other experiments, or lab exam.

If you fail to provide complete lab notebook work for any three or more experiments, you will receive a zero for the lab grade, and your mark for the entire course will not be more than 49/100, regardless of your performance on assignments, midterms and exams.

There are five assignments and three in-class quizzes throughout the semester. Solving assignments and questions in tutorials and quizzes will significantly help you succeed in the course. Discussion with other students on assignment questions is always welcomed but make sure you can do the problems yourself as all in-class exams are closed books, and you will be working on exams yourself. Late submission without a valid reason will affect your grade!

	Assignment	Assignment	
	Handing out	Due	Quiz
01	Jan. 17	Jan. 25	
02	Jan. 31	Feb. 08	Feb. 09
03	Feb. 28	Mar. 07	Mar. 15
04	Mar. 13	Mar. 21	Apr. 05
05	Mar. 27	Apr. 04	

## Exams

Quizzes: In class

Midterm: 16 February 2023 (Friday) [Time: 10:30 am – 11:20 am]

Lab exam: TBA

Final: The final exam date will be set by the University registrar.

## Course Contents

Note: Due to COVID and future unseeable circumstances, we might not have enough time to finish all the chapters. In this scenario, we will discard the last few chapters in Magnetism!

### Chapter 12 Thermodynamics

- 12.1 Heat and the First Law of Thermodynamics
- 12.2 Thermal Expansion
- 12.3 Specific Heat and Heat of Transformation
- 12.4 Calorimetry
- 12.5 Heat Transfer
- 12.6 The Ideal Gas: A model System
- 12.7 Thermodynamics of Ideal Gases
- 12.8 Enthalpy

### Chapter 13 Kinetic Theory

- 13.1 Connecting the Microscopic and the Macroscopic
- 13.2 Molecular Speeds and Collisions
- 13.3 The Kinetic Theory of Gases
- 13.4 Thermal Energy and Specific Heat
- 13.5  $k_B T$  and the Boltzmann Factor
- 13.6 Reaction Kinetics and Catalysis
- 13.7 Diffusion

### Chapter 14 Entropy and Free Energy

- 14.1 Reversible and Irreversible Processes
- 14.2 Microstates, Multiplicity, and Entropy
- 14.3 Using Entropy
- 14.4 Spontaneity and Gibbs Free Energy
- 14.5 Doing Useful Work
- 14.6 Using Gibbs Free Energy
- 14.7 Mixing and Osmosis

### Chapter 15 Oscillations

- 15.1 Simple Harmonic Motion
- 15.2 SHM and Circular Motion
- 15.3 Energy in SHM
- 15.4 Linear Restoring Force

- 15.5 The Pendulum
- 15.6 Damped Oscillation
- 15.7 Driven Oscillations and Resonance

Chapter 16

- Travelling Waves and Sound
- 16.1 An introduction to Waves
  - 16.2 Visualizing Wave Motion
  - 16.3 Sinusoidal Waves
  - 16.4 Sound and Light
  - 16.5 Circular and Spherical Waves
  - 16.6 Power, Intensity, and Decibels
  - 16.7 The Doppler Effect

Chapter 17

- Superposition and Standing Waves
- 17.1 The Principle of Superposition
  - 17.2 Standing Waves
  - 17.3 Standing Waves on a String
  - 17.4 Standing Sound Waves
  - 17.5 The Physics of Speech
  - 17.6 Interference Along a Line
  - 17.7 Interference and Two and Three Dimensions
  - 17.8 Beats

Chapter 18

- Wave Optics
- 18.1 Models of Light
  - 18.2 Thin-Film Interference
  - 18.3 Double-Slit Interference
  - 18.4 The Diffraction Grating
  - 18.5 Single-Slit Diffraction
  - 18.6 Circular Aperture Diffraction
  - 18.7 X Rays and X-Ray Diffraction

Chapter 19

- Ray Optics
- 18.1 The Camera
  - 18.2 The Human Eye and Magnifier
  - 18.3 The Microscope and Telescope
  - 18.4 Color and Dispersion
  - 18.5 Resolution of Optical Instruments

Chapter 20

- Optical Instruments
- 20.1 Lenses in Combination
  - 20.2 The Camera
  - 20.3 The Human Eye
  - 20.4 Magnifiers and Microscopes
  - 20.5 The Resolution of Optical Instruments
  - 20.6 Microscopy

Chapter 21	Electric Forces and Fields
	21.1 The Charge Model
	21.2 A Microscopic Model of Charge
	21.3 Coulomb's Law
	21.4 The Electric Field
	21.5 The Electric Field of Multiple Charges
	21.6 The Motion of a Charged Particle in an Electric Field
	21.7 The Torque on a Dipole in an Electric Field
Chapter 22	Electric Potential
	22.1 Electric Potential Energy
	22.2 The Electric Potential
	22.3 Calculating the Electric Potential
	22.4 The Potential of a Continuous Distribution of Charge
	22.5 Source of Electric Potential
	22.6 Connecting Potential and Field
	22.7 The Electrocardiogram
Chapter 23	Biological Applications of Electric Fields and Potentials
	23.1 Capacitance and Capacitors
	23.2 Combinations of Capacitors
	23.3 Dielectrics
	23.4 Electrostatics in Salt Water
	23.5 The Membrane Potential of a Cell
Chapter 24	Current and Resistance
	24.1 A Model of Current
	24.2 Defining Current
	24.3 Batteries and emf
	24.4 Resistance and Conductance
	24.5 Ohm's Law and Resistor Circuits
	24.6 Energy and Power
	24.7 Alternating Current
Chapter 25	Circuits
	25.1 Circuit Elements and Diagrams
	25.2 Using Kirchoff's Laws
	25.3 Series and Parallel Circuits
	25.4 Measuring Voltage and Current
	25.5 More Complex Circuits
	25.6 Electric Safety
	25.7 RC Circuits
	25.8 Electricity in the Nervous System

- Chapter 26      Magnetic Fields and Forces
- 26.1    Magnetism
  - 26.2    The Magnetic Field of a Current
  - 26.3    Magnetic Dipoles
  - 26.4    The Magnetic Force on a Moving Charge
  - 26.5    Magnetic Forces on Current Carrying Wires
  - 26.6    Forces and Torques on Magnetic Dipoles
  - 26.7    Magnetic Resonance Imaging
- Chapter 27      Magnetic Fields and Forces
- 27.1    Induced Current
  - 27.2    Motional emf
  - 27.3    Magnetic Flux and Lenz's Law
  - 27.4    Faraday's Law
  - 27.5    Induced Fields
  - 27.6    Electromagnetic Waves
  - 27.7    Polarization

### Academic Integrity

The university has a strict policy against academic dishonesty. For a precise definition of what St. Francis Xavier University considers to be academic dishonesty, please refer to <https://www.stfx.ca/applications-admissions/registrars-office/academic-integrity>. It is your responsibility to know what constitutes academic dishonesty.