

Malvern Collegiate Institute – Physics

SPH4U Course Outline 2021 – 2022

Teacher: A. Hang

Prerequisite: 11 University Physics (SPH3U)

Introduction: SPH4U is a course that will prepare the students for first year university physics courses. In order to do so, the level of mathematics required is substantially higher than that of the grade twelve courses. This course enables students to deepen their understanding of the concepts and theories of physics. Students will explore further the laws of dynamics and energy transformations, and will investigate electrical, gravitational, and magnetic fields; electromagnetic radiation; and the interface between energy and matter. They will further develop inquiry skills, learning, for example, how the interpretation of experimental data can provide indirect evidence to support the development of a scientific model. Students will also consider the impact on society and the environment of technological applications of physics.

Unit One: Kinematics and Dynamics

By the end of this unit, students will:

- Analyse technological devices that apply the principles of the dynamics of motion, and assess the technologies' social and environmental impact;
- Investigate, in qualitative and quantitative terms, forces involved in uniform circular motion and motion in a plane, and solve related problems;
- Demonstrate an understanding of the forces involved in uniform circular motion and motion in a plane.

This unit expands of the study of motion that began in the introductory course and introduces the concept of circular motion. The unit will also include a further examination of Newton's laws, with applications such as projectile motion, centripetal acceleration, as well as conditions required to maintain static equilibrium.

Unit Two: Energy and Momentum

By the end of this unit, students will:

- Analyse, and propose ways to improve, technologies or procedures that apply principles related to energy and momentum, and assess the social and environmental impact of these technologies or procedures;
- Investigate, in qualitative and quantitative terms, through laboratory inquiry or computer simulation, the relationship between the laws of conservation of energy and conservation of momentum, and solve related problems;
- Demonstrate an understanding of work, energy, momentum, and the laws of conservation of energy and conservation of momentum, in one and two dimensions.

The laws of conservation of energy and momentum are examined in this unit as an alternate method of analyzing motion in one and two dimensional problems. The unit will also include an introduction to classical planetary mechanics (highlighting the historical contributions of Copernicus, Brahe, Kepler and Newton) with particular emphasis placed on the gravitational potential energy required to maintain the system.

Unit Three: Gravitational, Electric, and Magnetic Fields

By the end of this unit, students will:

- Analyse the operation of technologies that use gravitational, electric, or magnetic fields, and assess the technologies' social and environmental impact;
- Investigate, in qualitative and quantitative terms, gravitational, electric, and magnetic fields, and solve related problems;
- Demonstrate an understanding of the concepts, properties, principles, and laws related to gravitational, electric, and magnetic fields and their interactions with matter.

In this unit, students are expected to demonstrate an understanding of the concepts, principles and laws related to electric, gravitational and magnetic forces and fields. The differences and similarities between Coulomb's law and Newton's law of universal gravitation will be compared and contrasted in specific contexts.

Unit Four: The Wave Nature of Light

By the end of this unit, students will:

- Analyse technologies that use the wave nature of light, and assess their impact on society and the environment;
- Investigate, in qualitative and quantitative terms, the properties of waves and light, and solve related problems;
- Demonstrate an understanding of the properties of waves and light in relation to diffraction, refraction, interference, and polarization.

The basic properties of waves are re-examined with respect to light as a wave phenomena. Diffraction and interference of light are theoretically and practically analyzed.

Unit Five: Modern Physics: Quantum Mechanics and Special Relativity

By the end of this unit, students will:

- Analyse, with reference to quantum mechanics and relativity, how the introduction of new conceptual models and theories can influence and/or change scientific thought and lead to the development of new technologies;
- Investigate special relativity and quantum mechanics, and solve related problems;
- Demonstrate an understanding of the evidence that supports the basic concepts of quantum mechanics and Einstein's theory of special relativity.

This unit introduces the Compton and photoelectric effects to explain the wave-particle duality of nature. The basic ideas of Einstein's special theory of relativity (including such topics as time dilation, length contraction, and $E = mc^2$), and early quantum mechanics are explored.

Assessment & Evaluation:

- Course work (test, quizzes, assignments, laboratory investigations and reports, projects, etc.) will account for **85% of your final mark.**
- A course culminating activity (summative) will account for the remaining **15%** of your final mark. This is subject to change.

Both course work AND any summative evaluations will be evaluated with reference to the categories outlined below:

Knowledge & Understanding	25%
Thinking and Investigation	25%
Communication	20%
Application	<u>30%</u>
	100%

The report card mark will be a cumulative Year-to-Date mark (YTD). The category weights given above are tentative and are therefore subject to modifications throughout the course of the year. Students will be notified of any changes.

Assessment and Evaluation Policy:

Please refer to the MCI Evaluation Policy 2020 - 2021: Science Department and your agenda.

Resource:

Textbook: *Physics 12, Nelson, 2012*

The BEST WAY to reach Mr. Hang is via email:

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