ST. FRANCIS ACADEMY

A division of St. Francis Methodist School

Curriculum Description for Australian Matriculation (Tertiary Entrance Examinations)

PHYSICS

Physics is an experimental discipline involving the study of the properties of, and interrelationships between energy and matter. Physics assists us to construct models or explanations of physical phenomena. These, in turn, allow us to develop a deeper understanding of the world around us. For instance, by studying the nature of particles that make up atoms, students develop an understanding of the way an electrical circuit works and what measures we can take to protect ourselves and others when working with electricity. Physics also allows us to understand why high-speed collisions are more damaging than low-speed collisions; why we may need optical devices to assist our vision; and why gravity, the force that controls the motion of a falling stone, can also result in the collapse of a massive star to produce a black hole.

Physics, like other scientific disciplines, is continually evolving. The practice of physics requires observation, investigation, data collection and data evaluation in order to construct and modify models of physical phenomena. This course mirrors scientific processes by encouraging students to refine and reconstruct the models of physical phenomena they already hold in ways that help them to build robust understandings of important concepts. This course also encourages the effective communication of those understandings to others.

Students construct models about how objects and systems interact with one another and how interactions can produce changes. The contextual approach of this course helps them both to appreciate the relevance of physics to their everyday experiences, and to gain insight into experiences that are far from the everyday. They achieve the outcomes by gaining and building on the knowledge, skills, understandings and values developed in a range of content areas and contexts.

This course caters for students of varying interests and backgrounds. Achievement of the course outcomes allows students to be responsible and efficient users of products and processes at home or in the workplace. Students pursuing post-secondary education at TAFE will find that their studies in physics have provided them with foundation knowledge that will support their studies in many areas such as those requiring laboratory and technical skills, as well as those leading to electrical and other physics-related vocations. This course also provides prerequisite, preferred or highly desirable knowledge and skills for many science, engineering and science-related courses at tertiary institutions.

This course is designed to stimulate and foster intellectual curiosity and promote logical, analytical and reflective thinking. It aims to prepare students to become informed citizens who are able to communicate their ideas effectively and participate in discussions of challenging issues. They are encouraged to take an informed and critical interest in science and make decisions on a range of scientific and technological issues that will influence the quality of their lives and the environment.

Students should encounter the unit content of the Physics course through a range of contexts that are familiar to them. A variety of suitable contexts is listed.

Through engaging with this course, students have the opportunity to further their achievement of specific overarching learning outcomes from the Curriculum Framework. The course also provides opportunities for the promotion of core-shared values identified from the Curriculum Framework.

Course outcomes
The Physics course is designed to facilitate the achievement of three outcomes. These outcomes are based on the Science learning area outcomes in the Curriculum Framework. Outcomes are statements of what students should know, understand, value and be able to do as a result of their learning.

Outcomes are elaborated into aspects that identify the underpinning knowledge, concepts and/or skills in more detail.

Outcome 1: Investigating and communicating in physics
Students investigate physical phenomena and systems, collect and evaluate data, and communicate their findings.
In achieving this outcome, students:
- develop questions and ideas about the physical world to prepare an investigation plan;
- conduct experiments and investigations;
- analyse data and draw conclusions based on evidence;
- evaluate the accuracy and precision of experimental data and the effectiveness of their experimental design; and
- communicate and apply physics skills and understandings in a range of contexts.

Outcome 2: Energy
Students apply understanding of energy to explain and predict physical phenomena.
In achieving this outcome, students:
- apply understanding of conceptual models and laws relating to energy; and
- apply understanding of mathematical models and laws relating to energy.

Outcome 3: Forces and fields
Students apply understanding of forces and fields to explain physical phenomena.
In achieving this outcome, students:
- apply understanding of conceptual models and laws relating to forces and fields;
- apply understanding of mathematical models and laws relating to forces and fields; and
- apply understanding of the vector nature of some physical quantities.

For each of these outcomes, standards are defined in terms of progressive levels of achievement (see Course Standards).

Course content
The course content is the focus of the learning program. It enables students to maximise their achievement of both the overarching learning outcomes from the Curriculum Framework and the Physics course outcomes. By engaging with this course content, students can demonstrate their achievement.

The course content is divided into five content areas:
- working in physics (all units)
- forces and movement (units 1A, 2A, 3A and 3B)
- waves (units 1B, 2B and 3B)
- electricity and magnetism (units 1B, 2B, 3A and 3B)
- particles (units 1A, 2A, 3B).

Working in physics
Fundamental to the practice of physics is the capacity to carry out physical investigations. Students working in physics develop fundamental skills and processes used in scientific investigations. They identify and research real world problems, initially with direction, but with the aim of developing independent research skills. Understanding how people develop and advance physics is fundamental to understanding the evolutionary nature of the scientific knowledge and processes physicists apply when solving problems and making decisions.

Students encounter many examples of how physics affects their lives. As their skills and knowledge grow, they develop increasingly sophisticated models of how the laws and principles of physics apply in various situations and how to use them to find solutions to problems.

Forces and movement
Building on the concepts of displacement, velocity and acceleration, students learn about forces and their effects. They encounter the conservation laws pertaining to momentum and energy, and ultimately find out about relativity and its implications.

Waves
As they investigate waves, students develop an understanding of wave characteristics, and apply these ideas to the transmission of waves, and to interactions between waves and the medium, or between waves. They appreciate the importance of waves in transferring energy and to communicate information.

Electricity and magnetism
Students investigate a range of concepts such as direct and alternating current, resistance, electric potential, potential difference, and energy. They also learn about the relationships between moving charges and magnetic fields. They encounter a variety of ways to describe and explain electromagnetic phenomena, such as those advanced by Ampère, Faraday, Henry, Lenz and Maxwell. They develop an understanding of the underlying theories of electricity and magnetism as they investigate a variety of applications.

Particles
An understanding of the concepts of temperature, heat and internal energy is the foundation for the study of the effects of heating and cooling. In developing further understandings of the ways in which particles interact with one another, students learn about atoms and atomic theory. In further study, they develop this to include nuclear energy and changes, and then to the quantum physics of atoms and photons.

Course units
To cater for the full range of students, six units have been developed to sequence the syllabus content. Stage 1 units enable student achievement at levels 3 to 5; Stage 2 units at levels 4 to 6; and Stage 3 units at levels 6 to 8.

Each of the units is designed around unit content areas which increase in complexity from one unit to the next. Each unit allows students to achieve all three of the course outcomes.

For students intending to sit an external examination, it is expected that they will have completed either 2A/2B or 3A/3B as their final pair of units.

Unit 1APHY
The unit focus is on **moving around** and **heating and cooling**. Within the focus of **moving around**, students gain fundamental knowledge about the movement of objects; energy relationships involved in movement; and the conditions required for objects to retain their stability and avoid falling over. Within the focus of **heating and cooling**, they learn about temperature measurement, conduction and convection to develop understandings about how heat is transferred through different types of materials. With direction, they investigate real world problems.

Unit 1BPHY
The unit focus is on **seeing things** and **electricity**. Within the focus of **seeing things**, students develop a fundamental understanding of some of the ways that we use light, especially the use of mirrors and lenses to form images. **Electricity** is introduced through the study of the relationship between electricity and atomic structure, electrical charge, and electrical circuits. They begin to develop their own investigations of real world problems.

Unit 2APHY
The unit focus is on **motion and forces** and **nuclear physics**. Within the focus of **motion and forces**, students develop their understanding of motion in one dimension to solve both qualitative and quantitative problems. Through the study of **nuclear physics**, they learn about atomic structure and sub-atomic particles to understand and appreciate phenomena such as those that lead to the emission of nuclear radiation, and nuclear energy. They are encouraged to develop their own investigations of real world problems, extending their investigative and communication skills. They quantify the error in measurements made in their experiments, and engage with more abstract questions to select appropriate problem-solving strategies.

Unit 2BPHY
The unit focus is on **waves and the Universe** and **electrical fundamentals**. In learning about **waves and the Universe**, students gain insight into the scale of the observable entities in our Universe, from sub-atomic particles to the Universe itself. They relate physical principles about waves to the study of the Universe and its parts. They develop an understanding of the characteristics of waves, and how they interact with the medium. Within the focus of **electrical fundamentals,** they learn to apply the concepts of charge and energy transfer to situations involving both electrostatics and current electricity. They construct and study characteristics of electric circuits; learn how to work safely with electricity; and gain a more comprehensive understanding of the relationship between electricity and magnetism. They research real world problems and plan to carry out an investigation, and deal with abstract concepts and principles when selecting problem-solving techniques.

Unit 3APHY
The unit focus is on **motion and forces in a gravitational field** and **electricity and magnetism**. Within the focus of **motion and forces in a gravitational field**, students explore the motion of objects in gravitational fields, including the motion of projectiles, orbiting satellites, planets and moons, and ways in which forces may affect the stability of extended objects. Within the focus of **electricity and magnetism**, they also learn about magnetic fields and how they interact with moving charges in situations involving current electricity, the motor effect and electromagnetic induction. They identify real world problems, develop research questions to plan, conduct and evaluate investigations. Their problem-solving techniques include combinations of concepts and principles.

Unit 3BPHY
The unit focus is on **particles, waves and quanta** and **motion and forces in electric and magnetic fields**. Further study of mechanical and electromagnetic waves allows students to appreciate both classical and modern interpretations of the nature and behaviour of waves. Students learn how waves are used in a variety of technologies, such as in musical instruments, communication systems or sensing systems. Extending their knowledge of atomic physics, they analyse spectra and explain a range of physical phenomena such as fluorescence and x-ray emission. They also learn about some topics of modern physics such as relativity and cosmology. They research their own question and develop problem-solving strategies that involve linking a number of concepts and principles.

Examination details
External assessment is a requirement for students aspiring to university selection. Students need to complete at least two units from 2A—3B to be eligible to sit the WACE exam.

The total examination length is 3 hours and 10 minutes. This comprises a written paper of 3 hours working time and 10 minutes reading/planning time. It will assess Outcomes 1, 2 and 3 of the course. Where possible, examination items will be set in suitable contexts.

It is expected that students will have completed either 2A/2B or 3A/3B as their final pair of units.

The exam comprises five sections:
Section A: is compulsory.
Section B: is chosen if 2A is one of the latest pairs of units studied.
Section C: is chosen if 2B is one of the latest pairs of units studied.
Section D: is chosen if 3A is one of the latest pairs studied.
Section E: is chosen if 3B is one of the latest pairs studied.