Physics Form 3 Syllabus - September 2009 onwards

The new Physics SEC syllabus 2012 applies.

The new Physics SEC syllabus aims to develop students' understanding of Physics around them and how it affects their daily lives. It aims to develop students' questioning, analytical and problem solving approach to scientific problems and issues. It intends to develop students' practical skills in Physics and an understanding of how Physics works through an investigative approach. It aspires to connect the applications of Physics to technology and environmental issues and to develop students' understanding through a historical context within which scientific ideas are developed. It also intends to encourage a positive attitude towards science in general and the environment, and to create enthusiasm about Physics leading to further studies in the area.

The key features of the new syllabus are:

- Focus on a context-oriented approach.
- Focus on the needs of the students.
- Links with science, society and technology.
- Links with ICT.
- Reference to historical context.
- Encourages teaching through practical learning activities.

Topics to be covered in **Form 3**

Theme	***Reference nos***
Theme 1: On the Move	1.15 - 1.28
Theme 2: Balancing Forces	All
Theme 4: Staying Cool	All
Theme 8: The Earth and the Universe	All

It is suggested that a short unit about Measurement and S.I. Units is done either as an introductory chapter or incorporated with the other themes.

Theme 1 : On the move (1.15 - 1.28)

Learning Programme

- Energy, Work and Power
- Sources of Energy: renewable and non-renewable
- Ways of keeping our homes warm in winter and cool in summer.

Learning Outcomes

Learners will:

- Associate the ability to do work with energy.
- Know that energy is measured in Joules (J).
- Use the equation: Work = F s where 's' is the distance moved in the direction of the force.
- Understand the significance of the principle of Conservation of Energy.
- Give examples of conversion and conservation of energy in different states.
- Draw and explain energy flow diagrams through steady state systems.
- Know that gravitational potential energy and kinetic energy are two examples of mechanical energy.
- Use the following equations: P.E. = m g h and K.E. = ½ mv^2 in simple problems.
- Use the following equation: Power = $\frac{\text{Work done}}{\text{Time taken}}$ in simple calculations.
- Know the unit of power is Watt.
- Understand the meaning of efficiency.
- Use the following equation: Efficiency = $\frac{\text{Useful power output}}{\text{Useful power input}} \times 100$ (when given as a percentage.
- Describe how energy can be used efficiently in the context of the home, to heat and cool buildings.

- Understand the meaning of renewable and non-renewable forms of energy.
- Give examples of and classify sources of energy as renewable and non-renewable.
- State the advantages and disadvantages of using fossil fuels, nuclear, wind, hydroelectric, solar and biomass sources of energy.
- Discuss the importance of using energy resources efficiently especially with respect to their running costs and resulting pollution.

Theme 2: Balancing forces

Learning programme

- The nature and properties of forces.
- Identification of Newton's pairs of forces.
- Action of a force applied to a helical spring.
- Action of a force at a distance from a fulcrum.
- Bodies in equilibrium and the motion which results.
- The moment of a force.
- Pressure exerted by a force acting on an area.
- The properties of atmospheric pressure.

Learning Outcomes

Learners will:

- Identify such forces as weight (gravitational force), tension, contact forces and frictional forces.
- Draw these forces and know that each force acts in one direction.
- Know that the units of force is Newtons and that forces are measured using a Newton meter.
- Distinguish between mass and weight of an object.
- Use the equation: Weight = Mass x Acceleration due to gravity.
- Identify vector and scalar quantities and be classify basic quantities in Physics such as distance, displacement, speed, velocity, mass, weight, acceleration, momentum and pressure as being vectors or scalars.

- Set up an experiment to verify the behaviour of a helical spring when subjected to an increasing force. Plot a graph of force against the extension of the spring.
- State Hooke's law and solve simple problems related to it.
- Know the meaning of 'elastic limit' as applied to objects which stretch.
- Know that the turning effect of a force (moment) depends on the size of the force and the perpendicular distance from the pivot to the line of action of the force.
- Use the equation: Moment = F s, where s is the perpendicular distance from the pivot to the line of action of the force.
- State the principle of moments.
- Set up the apparatus required to investigate the principle of moments.
- Identify the two conditions required for a body to be in equilibrium.
- Solve simple problems where bodies in equilibrium are supported by one pivot.
- Identify the centre of gravity (centre of mass) of a body as the point where all the weight of the body seems to act.
- Know that a force acting on a body cause pressure.
- Use the equation Pressure = $\frac{\text{Force}}{\text{Area}}$ in simple problems.
- Apply the inverse relation between Pressure and Area to familiar situation.
- Know that the unit of pressure is Pascal (Pa) and that 1 Pa is 1 N/m^2.
- Relate the pressure beneath a liquid surface to depth and to density of liquid.
- Use the equation: Pressure = ρ h g.
- Know that liquids transmit pressure in all directions enabling force to be magnified. Apply the equation of pressure to simple hydraulic machines.
- Know that the atmosphere exerts a pressure and that this pressure decreases to zero with increase in height above the Earth's surface.
- Describe qualitatively how the pressure of a fixed mass of gas is affected by changes in its temperature and volume.

Theme 4: Staying Cool

Learning programme

- Density and its measurement.
- Three methods of heat transfer: conduction, convection and radiation.
- Good and bad conductors of heat and their practical applications.
- Good and bad emitters and good and bad absorbers of heat energy with practical examples.
- The use of glass to trap heat radiation e.g. in solar panels.
- Specific heat capacity.
- Expansion.
- Evaporation.

Learning Outcomes

Learners will:

- Describe qualitatively the molecular structure of solids, liquids and gases and the motion of their particles.
- Use the equation: Density = $\frac{\text{Mass}}{\text{Volume}}$ in simple problems. Recall the units of density as kg/m^3 and g/cm^3.
- Select and use apparatus to calculate the density of different materials of regular shape and irregular shape.
- Explain floating and sinking in terms of density.
- Know that a hotter a substances is, the more energy its particles have, resulting in expansion.
- Recall that the unit of energy is Joule (J) and the unit of temperature is deg. Celsius (^{o}C).
- Relate a rise in temperature of a body to an increase in internal energy.
- Describe evaporation in terms of the escape of the more energetic molecules from the surface of a liquid.

- Relate evaporation to cooling.
- Select apparatus and set up experiment to measure the specific heat capacity of a liquid or a metal using an electric heater of known power or joulemeter.
- Use the equation: $\Delta Q = m c \Delta\theta$
- Know that the units of specific heat capacity are J (kg ^{o}C).
- Know that a temperature difference may cause energy transfer, called heat.
- Differentiate between heat conductors and insulators.
- Name examples of good and bad conductors of heat.
- Set up an experiment to distinguish between good and bad conductors of heat.
- Know that convection currents in fluids are caused by a difference in density due to expansion which is caused by heat energy.
- Know that all objects which are warmer than the surroundings radiate heat energy (infra-red radiation) in the form of waves.
- Set up an experiment to investigate how different coloured materials act as good or bad absorbers of heat energy.
- Set up an experiment to investigate how different coloured materials act as good or bad emitters of heat energy.

Theme 8: The Earth and the Universe

Learning Programme:

- The earth spins upon itself once a day, and around the sun to give night and day.
- The Earth orbits the Sun once in 365 days.
- The moon orbits the Earth and the planets the Sun because of gravitational force.
- Satellites can be used for different purposes such as communication and monitoring of the Earth.
- Planets in our solar system have different characteristics.
- The difference between planets, stars and galaxies.
- Conditions for living in space.
- Space Exploration and its benefits.

- The historical development of ideas about the Earth and the Universe

Learning Outcomes

Learners will:

- Describe how the day and the night results from the Earth's spin upon itself.
- Recall that the Earth takes about 365 days to orbit the sun.
- Explain how the periodic journey of the Earth and its tilt give rise to seasons.
- Explain the role of gravity both on Earth as well as in space to keep objects orbiting around each other.
- Understand the force of gravity as the force of attraction between objects and that this force of attraction increases with mass and decreases with distance.
- Use the force of gravity to describe how (i) the moon and (ii) satellites orbit the Earth.
- Recall and understand the definition of a planet as being a celestial body that:

  is in orbit around the sun;

  has a nearly round shape;

  has cleared the neighbourhood around its orbit.
- Name the eight major planets of our Solar system.
- Identify Pluto as a 'dwarf planet' because it has not cleared the neighbourhood around its orbit.
- Identify our solar system as part of the Milky Way galaxy which is a small part of the Universe.
- Know that distances in space are measured in 'light years', and that one light year is the distance that light travels in one year.
- Name the instruments which can be used to observe the sky (light and radio telescopes).
- Identify a few of the social benefits of space explorations.
- Identify unanswered questions about our Universe.

Use of ICT as a tool for teaching and learning

The use of ICT in the classroom and beyond is an integral part of the teaching and learning of Physics. Each theme in the new Physics SEC syllabus is preceded by a number of web-links related to the theme. It is hoped that these links will be further developed by SEC over the years. Web simulations, PowerPoint presentations, web video clips, participation in online science projects and other innovate technology must be an integral part of the pedagogy in the classroom and beyond.

Language of Communication

The English language should be the principal language of communication during the Physics lessons. This may be supplemented with the Maltese language in those instances where the teacher feels it is appropriate. Communicate in the English language helps the students to grasp the key phrases, understand better the HW assignments and tests, communicate better both verbally and when writing. One must remember that all science resources, both in books and digital are in the English language.

Assessment

Assessment for Learning should be an integral part of each and every lesson. Each question asked during the lesson is an opportunity for further learning. Every feedback given and comment shared between the teacher and the students is an opportunity to assess, encourage and elaborate about the students' learning process.

Students will be assessed by means of a school-based examination for their Half Yearly Examination. Even this examination can be an opportunity for formative assessment when the teacher uses the answers provided by the students to identify needs and encourage further learning. The end-of-year summative assessment will be in the form of an Annual Examination which will consist of a national examination paper set by the Curriculum Management and eLearning Department. This examination will have a total of 85 marks. The remaining 15 marks will be assigned to the practical work done by students and reported in their Lab Book. Teachers are highly encouraged to use an inquiry based approach to practical work with the students as part of their practical work portfolio.

Experiments & Investigations

This new 2012 Physics SEC syllabus stipulates that at the end of the three year Physics course, students should present for SEC moderation:

Either 15 experiments

Or 13 experiments and a longer investigation which will be equivalent to the work done to perform two experiments.

It is also recommended that students present at least two experiments from each of the themes 1 - 6. The investigation may be chosen from any area of the syllabus. Simple experiments using data loggers are recommended.

Report Writing

Each school should develop a policy of gradual introduction of laboratory work report writing, starting from Form 3 onwards. Students need to be slowly integrated into the norms of report writing of practical work or investigations. The skill of report writing needs to be learned. An added bonus for the students is when they know beforehand the detailed criteria of how the teacher will assess the experimental report.

Gaetano Bugeja (EO Physics)
June 2010