Subject:	Physics (PH) – ELECTIVE
Subject Outline:	This subject aims to develop students' understanding of the key areas of physics with an emphasis on modern or quantum physics.
Objectives:	On successful completion of this subject, students will be able to: 1. Apply knowledge of physics theories and principles to solve problems (GA2, 5); 2. Analyse, evaluate and present information from a range of sources on physics topics (GA 1, 2, 7); 3. Solve problems of physics using complex reasoning (GA 2, 5); 4. Deliver a presentation on a physics topic and contribute to group discussion (GA 1, 2, 6); 5. Evaluate the strengths and limitations of scientific work in relation to physics (GA 2, 5, 7); 6. Operate safely and proficiently while conducting physics activities (GA 2, 6).
Graduate Attributes (GA):	On completion of the Foundation Program, students will be able to: 1. Communicate effectively in English in a variety of contexts, circumstances and modes 2. Demonstrate relevant, practical and theoretical knowledge in a subject area 3. Apply relevant academic literacy skills in a subject area 4. Apply relevant numeric literacy skills in a subject area 5. Apply critical, analytical thinking, and problem solving skills for academic contexts 6. Work independently and collaboratively in a cross-cultural context 7. Demonstrate academic integrity
Contact Time:	➢ **Standard Students** – Four (4) hours per week including one (1) hour tutorial ➢ **Express Students** – Five (5) hours per week
Attendance:	Students are expected to attend all classes, lectures and practical sessions. Attendance is highly valued and contributes directly to the academic success of the student. Attendance is monitored as described in the Attendance Policy.
Tutorials:	Standard students receive assistance from tutors, which involves clarifying concepts discussed in teacher classes, helping students to comprehend and solve questions/problems and providing direction for students about current assessment activities. Express students while not having tutorials, do have less structured student led sessions as part of their program, which encourage students to actively participate in class.
Student Textbook:	OpenStax College, *College Physics*. OpenStax College. 21 June 2012. <http://cnx.org/content/col11406/latest/>.
Content and Skills :	**Physical Quantities and Measurement** ● Scientific notation and metric prefixes ● Errors in measurement ● Algebraic and Graphical analysis ● Vectors and Scalars ● Addition, subtraction and resolution of Vectors **Kinematics** ● Speed and velocity/Graphing non-accelerating motion ● Acceleration/using velocity—time graphs to find acceleration ● Graphs of motion ● Circular Motion and radian measure ● Centripetal force ● Vertical and horizontal motion under gravity.

Dynamics

- Newton's three Laws
- Balanced and unbalanced forces
- Applications of Forces
- Universal law of Gravitation

Energy And Momentum

- Energy and Power
- Forms of Energy, its conversion and conservation
- Work
- Potential Energy
- Kinetic Energy
- Elastic potential energy
- Mechanical Power

Momentum

- The conservation of momentum
- Elastic and inelastic collisions
- Collisions in two dimensions

Waves

- Simple Harmonic Motion
- Harmonic motion, period and frequency
- The simple pendulum
- Wave equation
- Wave energy
- Boundary behaviour
- Reflection, Refraction and Diffraction
- Wave interference and resonance

Electromagnetism

- Static Electricity
- Attraction and repulsion of electric charges
- The atomic theory of matter
- Coulomb's Law
- Electric Potential
- Uniform Electric Fields.

Electric Current

- Electric current
- Conductivity in metals
- Potential difference

Magnetism

- The magnetic effects of electricity
- The magnetic force on moving charges
- Coils in magnetic fields and their applications (galvanometers, loudspeakers, motors)
- The force on a moving charged particle (inc the mass spectrometer)
- Lenz's law and Flux.
- AC and DC generators.
- Electromagnetic Waves

	Modern Physics Wave nature of Light ● Reflection, refraction and Total internal Reflection ● Double Slit experiment ● Diffraction ● Interference ● Electromagnetic spectrum Particle nature of Light ● Black Body radiation ● The Photoelectric effect ● X-rays ● Photon momentum ● Wave/particle duality Atomic and nuclear physics ● Historical development of atomic theory ● Bohr's Model of the atom ● Rutherford's scattering experiment ● The wave nature of particles ● The structure of the nucleus ● Radioactivity and Half-life ● Uses and hazards of radioactivity ● Nuclear fission ● Elementary nuclear particles

Students in the standard program are assessed through the following assessment activities:

Assessment Activity	Description	Weighting
Homework	Throughout the program, students are given homework exercises that have vocabulary, reading and problems for the purposes of preparation, practice and revision of relevant content and skills. Homework exercises are submitted online through the Moodle Learning Managemant System.	10%
Progress Test 1	Students complete the 50 minute written Progress Test 1 under IES examination conditions. Section A of the test contains concept questions which require brief written responses or summaries of concepts. Section B requires short responses based on problems or diagrams, either using sentences or equations and calculations. Responses to Section C require linking of ideas to solve more complex problems. General Topics: Forces, Motion, Work and Energy, Electric Forces, Electric Fields, Electric Potential Energy	10%
Seminar	Students work in groups to prepare and to present a seminar based on this purpose statement: ***Alternative energy sources use Physics principles to separate electric charges so that they can do useful work to improve people's lives.***	10%

	The group works together to research an alternative energy source and how it can be used to separate electric charges, giving details of two (2) specific contemporary applications of Physics technology that use the alternative energy source. Research questions and independent and dependent variables that could guide scientific research into the potential usefulness of the alternative energy source in the region are identified. Students also work collaboratively to consider ethical issues in Physics research. Sources of information are evaluated and correctly referenced.	
UQ Laboratory	Students undertake two (2) of three (3) experiments and demonstrate competency in using correct procedures in the Physics laboratory at the University of Queensland. Students collect, record and analyse experimental data to complete a laboratory booklet. Each student completes a UQ Lab Test (included in the Mid Course Exam) demonstrating their understanding of the principles and procedures learned during their lab experience.	5%
Mid-Course Exam	Students complete the 150 minute written Mid Course Exam paper under IES examination conditions. Section A of the exam contains concept questions which will require short written responses. Section B contains problem questions, which require calculations and drawing, labeling and interpreting diagrams. Section C requires solutions to complex and/or novel physics problems showing clear working and reasoning. Section D is A UQ Laboratory test that provides background theory and data and requires students to identify variables, analyse the data and draw a conclusion. Section D follows the same format as the UQ Laboratory booklet. General Topics: Magnetism, Electromagnetic Induction, Electromagnetic Waves	20%
Progress Test 2	Students complete the 50 minute written Progress Test 2 under IES examination conditions. Section A of the test contains concept questions which require brief written responses or summaries of concepts. Section B requires short responses based on problems or diagrams, either using sentences or equations and calculations. Responses to Section C require linking of ideas to solve more complex problems. General Topics: Refraction, Interference, Diffraction, Relativity	10%
Research Assignment	As part of the Physics course, each student must write a formal research report of approximately 1000 words on an investigation that consists of three (3) experiments performed using an experimental simulation, based on this purpose statement: ***Solving real world problems through Physics research involves experimental investigation to determine mathematical relationships between sets of independent and dependent variables***. Work is completed in and out of class.	10%
Final Exam	Students complete the 150 minute written Final Exam under IES examination conditions. Section A of the exam contains concept questions which require short written responses. Section B contains problem questions, which require use of calculations and drawing, labeling and interpreting diagrams. Section C requires solutions to complex and/or novel physics problems showing clear working and reasoning.	25%

Students in the express program are assessed through the following assessment activities:

Assessment Activity	Description	Weighting
Homework	Throughout the program, students are given homework exercises that have vocabulary, reading and problems for the purposes of preparation, practice and revision of relevant content and skills. Homework exercises are submitted online through the Moodle Learning Managemant System.	10%
End of Trimester Exams	Students complete 3 written exams (up to 90 minutes in length) under IES examination conditions, one at the end of each trimester. Section A of the test contains concept questions which require brief written responses or summaries of concepts. Section B requires short responses based on problems or diagrams, either using sentences or equations and calculations. Responses to Section C require linking of ideas to solve more complex problems.	60%
Seminar	Students work in groups to prepare and to present a seminar based on this purpose statement: ***Alternative energy sources use Physics principles to separate electric charges so that they can do useful work to improve people's lives.*** The group works together to research an alternative energy source and how it can be used to separate electric charges, giving details of two (2) specific contemporary applications of Physics technology that use the alternative energy source. Research questions and independent and dependent variables that could guide scientific research into the potential usefulness of the alternative energy source in the region are identified. Students also work collaboratively to consider ethical issues in Physics research. Sources of information are evaluated and correctly referenced.	10%
UQ Laboratory	Students undertake two (2) of three (3) experiments and demonstrate competency in using correct procedures in the Physics laboratory at the University of Queensland. Students collect, record and analyse experimental data to complete a laboratory booklet. Each student completes a UQ Lab Test demonstrating their understanding of the principles and procedures learned during their lab experience.	10%
Research Assignment	As part of the Physics course, each student must write a formal research report of approximately 1000 words on an investigation that consists of three (3) experiments performed using an experimental simulation, based on this purpose statement: ***Solving real world problems through Physics research involves experimental investigation to determine mathematical relationships between sets of independent and dependent variables***. Work is completed in and out of class.	10%