<table>
<tr><td>Module code</td><td colspan="3">SP-2301</td></tr>
<tr><td>Module Title</td><td colspan="3">Concepts in Modern Physics</td></tr>
<tr><td>Degree/Diploma</td><td colspan="3">Bachelor of Science (Applied Physics)</td></tr>
<tr><td>Type of Module</td><td colspan="3">Major Option</td></tr>
<tr><td rowspan="2">Modular Credits</td><td rowspan="2">4</td><td>Total student Workload</td><td>8 hours/week</td></tr>
<tr><td>Contact hours</td><td>4 hours/week</td></tr>
<tr><td>Prerequisite</td><td colspan="3">None</td></tr>
<tr><td>Anti-requisite</td><td colspan="3">SP-2202 Concepts in Modern Physics</td></tr>
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Aims

This module aims to introduce students to post-Newtonian concepts in physics that involve theories that were developed in the twentieth century.

Learning Outcomes

On successful completion of this module, a student will be expected to be able to:

Lower order :	30%	- understand the basic principles related to modern physics, which includes relativity, matter waves, energy quantisation, x-ray and also laser generation, and the nuclear structure
Middle order :	60%	- evaluate the effects of special relativity on time and length measurements - explain and apply equations developed to the effects of relativity on momentum and energy - explain and apply the concept of matter wave and wave-particle duality - apply the concept of atomic energy quantization to the electronic structure of atoms - explain the electronic transition process for x-ray generation and atomistic process for laser generation - explain quantized properties of nuclei contents
Higher order:	10%	- communicate concepts effectively - work independently and also participate as a team member in group discussions and problem solving sessions

Module Contents

- Einstein's special theory of relativity.
- Lorentz transformation equations to cover mechanics at all speeds, from which a basis for developing effects of relativity on other physical quantities like velocity, momentum, and energy will be established.
- Development of the idea of rest energy and a new definition of kinetic energy leading to the development and evaluation of Einstein's mass-energy relationship ($E=mc^2$).
- An introduction to the concepts photons, matter waves, and wave-particle duality.
- Wave function and the consideration of Schrödinger's equation to represent electron trap.
- The concept of quantization of atomic energies and the use of quantum numbers in describing energy states as well as a discussion of the periodic table.
- The electronic and atomistic process for x-ray and laser generation.
- An exploration of the quantum nature of the nuclear contents and their applications in NMR and MRI.

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<tr><td rowspan="3">Assessment</td><td>Formative assessment</td><td>Discussions, tutorials and feedback</td></tr>
<tr><td rowspan="2">Summative assessment</td><td>Examination: 60%</td></tr>
<tr><td>Coursework: 40%
- 2 tests (20%)
- 1 report and 2 assignments (20%)</td></tr>
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