<table>
<tr><td>Module code</td><td colspan="4">SP-2303</td></tr>
<tr><td>Module Title</td><td colspan="4">Quantum Mechanics and Atomic Physics</td></tr>
<tr><td>Degree/Diploma</td><td colspan="4">Bachelor of Science (Applied Physics)</td></tr>
<tr><td>Type of Module</td><td colspan="4">Major Option</td></tr>
<tr><td rowspan="2">Modular Credits</td><td rowspan="2">4</td><td>Total student Workload</td><td>8</td><td>hours/week</td></tr>
<tr><td>Contact hours</td><td>4</td><td>hours/week</td></tr>
<tr><td>Prerequisite</td><td colspan="4">None</td></tr>
<tr><td>Anti-requisite</td><td colspan="4">SP-2203 Quantum Mechanics and Atomic Physics</td></tr>
</table>

Aims

In this module, you will learn the fundamental principles of quantum mechanics and the mathematical techniques needed to state and apply them, for instance, to study the structure of atom with a single electron and many electrons. Quantum mechanics will also be used to study the bonding between atoms to form molecules.

Learning Outcomes

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

Lower order :	30%	- build up a sound knowledge of the mathematical ideas related to the quantum mechanical mechanical concepts - explain the concept of spin, spin angular momentum, its orientations, and Pauli's exclusion principle.
Middle order :	60%	- apply quantum mechanical operators to explain the concepts of quantization of energy, barrier penetration and emission of alpha particle(s) in radioactive nuclei
Higher order:	10%	- use quantum mechanical methods to model phenomena in physical systems including atoms, nucleus, molecules and solids.

Module Contents

Quantum Mechanics:

- Introduction to quantum mechanics, quantum mechanical operators
- Heisenberg uncertainty relation, Time-independent Schrödinger equation
- Stationary states, eigenstates and eigenvalues, bound states in a potential
- Infinite square well potential, potential step
- Free particle, probability current, parity operator, and harmonic oscillator.

Atomic Physics:

-Application of Schroedinger's equation to the hydrogen atom, hydrogen spectrum
- Origin of the quantum numbers, electronic probability density
- Selection rules, normal Zeeman's effect, electron spin, total angular momentum
- Exclusion principle, periodic table, electronic structure of elements, spin orbit coupling
- X-ray spectrum and Moseley plot

<table>
<tr><td rowspan="3">Assessment</td><td>Formative assessment</td><td>Problem-solving, tutorials, group discussions and feedback</td></tr>
<tr><td rowspan="2">Summative assessment</td><td>Examination: 60%</td></tr>
<tr><td>Coursework: 40%
- 3 assignments (20%)
- 3 class tests (20%)</td></tr>
</table>