Level Five

Quantum Mechanics

Course Code	Course Num.	Course Name	Credit Hours	Lec	Lab	Tut	Prerequisites
PHY	312	Quantum Mechanics	3	3	0	1	PHY 250, STA 111

Objectives:

Upon completion of the course, students are expected to:
- Familiarise themselves with basic principles and fundamental concepts of quantum mechanics.
- Provide a quantitative description of the Schrödinger's equation and its solutions.
- Increase awareness of the meaning of wavefunctions, eigenvalues, eigenfunctions and operators.
- Apply quantum mechanics to a range of model systems.

Syllabus:

List of Topics	No. of Weeks	Contact Hours
The Wave Function: matter waves; the probability concept; definition and properties of the wave function; the Max Born interpretation; the uncertainty principle, de Broglie relations.	2	8
The Schrödinger Equation: the wave equation of a free particle; time-dependent Schrödinger equation; the probability density; expectation values for position; expectation values for momentum and energy; operators; relations between expectation values and operators.	2	8
Steady-State Schrödinger Equation: time-independent Schrödinger equation; standing waves in a stretched string; eigenvalues and eigenfunctions; a particle in an infinite box; normalization.	3	12
The Finite Potential Well: a particle in a finite box; penetration depth; allowed energies for a restricted particle; classical versus quantum simple harmonic oscillator (SHO); quantized energy levels in SHO.	3	12
Tunneling Phenomena: the square potential barrier; penetration in a potential barrier; transmission probability of tunneling; scanning tunneling microscope.	2	8
Quantum Mechanics in Three Dimensions: Schrödinger equation in spherical coordinates; the hydrogen atom; separation of variables; principal, orbital and magnetic quantum numbers; electron probability density; Zeeman effect.	2	8

References:

- Modern Physics, 3rd ed., R Serway et al., Thomson Learning, 2005.
- Concepts of Modern Physics, 5th ed., A Beiser, McGraw-Hill, 2003.
- Introduction to Quantum Mechanics, 2nd ed., D J Griffiths, Pearson, 2005.
- Introduction to Quantum Mechanics, A C Phillips, Wiley, 2003.