B. Tech.	1	Semester	1 / 2	Teaching Scheme				Evaluation Scheme	
Subject Name	Physics - Quantum Mechanics			**L**	**T**	**P**	**Credits**	**CCE**	**SEE**
Subject Code	BTAS21107			3	0	0	3	50	50
Type of course	BSC: Basic Science Course			CCE: Continuous and Comprehensive Evaluation SEE : Semester End Evaluation					
Prerequisite	Basic understanding of Maths, Physics and Chemistry								
Rationale	The basic science - physics course is to prepare students for careers in engineering program where physics principles can be applied to the advancement of technology. This education at the intersection of engineering and physics will enable students to seek employment in engineering upon graduation while, at the same time, provide a firm foundation for the pursuit of graduate studies in engineering.								

Course Outcomes (COs): At the end of the course, students will be able to		**Marks % Weightage**
CO – 1	Describe the evolution of quantum theory through key experiments like blackbody radiation, photoelectric effect, and de Broglie's hypothesis.	17%
CO – 2	Explain the concept of wave functions and probability interpretation; demonstrate the use of Schrödinger equations for basic quantum systems.	17 %
CO – 3	Apply quantum models to solve problems involving energy quantization, tunneling, and potential wells and barriers.	17 %
CO – 4	Illustrate the role of angular momentum and quantum numbers in central potential systems using mathematical formulations.	13 %
CO – 5	Classify types of quantum confinement and analyse quantum mechanical behaviour in nanostructures and quantum computing applications.	19%
CO – 6	Interpret Bose-Einstein and Fermi-Dirac distributions and apply them to modern technologies like quantum sensors and communication systems.	17 %

Course Contents

Unit	**Content**	**Tentative Teaching Hours**	**Tentative Unit Weightage**
1.	**Unit 1: Foundations of Quantum Physics** • Historical Background: • Blackbody radiation and Planck's hypothesis. • Photoelectric effect and Einstein's explanation. • Compton scattering.	**05**	**17%**

	• de Broglie's hypothesis		
2.	**Unit 2: Mathematical Framework of Quantum Physics** • Wave Functions • Probability Interpretation • Time-Dependent Schrödinger Equation • Time-Independent Schrödinger Equation	**05**	**17 %**
3.	**Unit 3: Quantum Mechanics in One Dimension** • Potential Wells and Barriers: • Infinite potential well. • Finite potential well. • Potential barrier and tunneling effect with applications. • Energy quantization and zero-point energy.	**05**	**17 %**
4.	**Unit 4: Quantum Mechanics and Laser Physics** • Energy quantization and interaction of light with matter. • Spontaneous and stimulated emission • Einstein's A & B coefficients • Population inversion, optical amplification, and coherence properties. • Quantum cascade lasers	**04**	**13 %**
5.	**Unit 5: Quantum Statistics** • Bose-Einstein and Fermi-Dirac distributions. • Significance of various statics available. • Applications in understanding semiconductors and superconductors. • Emerging Technologies: Quantum sensors.	**06**	**19%**
6	**Unit 6: Applications of Quantum Physics** • Quantum Dots: • Quantum confinement and energy quantization in nanoscale materials. • Quantum Computing Basics: • Qubits and superposition.	**05**	**17 %**

Suggested Specification table with Marks

% Distribution of Marks					
R Level	**U Level**	**A Level**	**N Level**	**E Level**	**C Level**
30	40	30	--	--	--

Legends: R: Remembrance, **U:** Understanding; **A:** Application, **N:** Analyze, **E:** Evaluate **C:** Create and above Levels **(Revised Bloom's Taxonomy)**

Recommended Reference Books:

1. D. J. Griffiths and D. F. Schroeter, Introduction to Quantum Mechanics, 3rd ed. Cambridge, U.K.: Cambridge University Press, 2018. ISBN: 978-1107189638.
2. M. G. Raymer, Quantum Physics: What Everyone Needs to Know, 1st ed. New York, NY, USA: Oxford University Press, 2017. ISBN: 978-0190250713.
3. J. J. Sakurai and J. Napolitano, Modern Quantum Mechanics, 3rd ed. Cambridge, U.K.: Cambridge University Press, 2020. ISBN: 978-1108422413.
4. C. Cohen-Tannoudji, B. Diu, and F. Laloë, Quantum Mechanics, 1st ed. Hoboken, NJ, USA: Wiley, 1977. ISBN: 978-0471164333.
5. N. Zettili, Quantum Mechanics: Concepts and Applications. [Publisher, edition, and publication year not specified].

CO-PO-Mapping

CO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO – 1	3	3	1	1	-	-	-	-	-	-	-	3
CO – 2	3	3	-	3	-	-	-	-	-	-	-	3
CO – 3	3	1	3	3	3	-	-	-	-	-	-	-
CO – 4	3	-	1	3	3	-	-	-	-	-	3	-
CO – 5	3	1	-	1	3	-	3	-	-	-	-	3
CO - 6	3	-	-	-	-	3	3	-	-	-	-	3

List of Open Source/learning website/Other Details if any:

1. https://archive.nptel.ac.in/courses/115/106/115106133/
2. https://archive.nptel.ac.in/courses/115/101/115101107/
3. https://archive.nptel.ac.in/courses/115/103/115103104/
4. https://archive.nptel.ac.in/courses/115/104/115104096/