Chhatrapati Shahu Ji Maharaj University, Kanpur
Uttar Pradesh State University (Formerly Kanpur University, Kanpur)

Minutes of the Board of Studies (BoS) Meeting

Department of Physics | School of Basic Sciences

Date:	06 July 2026
Venue:	Department of Physics, School of Basic Sciences

1. Overview & Proceedings

The meeting of the Board of Studies (BoS) in the Department of Physics, School of Basic Sciences, CSJM University, Kanpur, was held on 06 July 2026 under the Chairmanship of the Director, School of Basic Sciences.The proposed syllabus of the M.Sc. Quantum Technology (Two-Year Programme) to be introduced from the Academic Session 2026–27 was presented before the Board. The curriculum, prepared in accordance with NEP-2020 and UGC guidelines, was discussed in detail by the members.

2. Attendance & Composition of the Board

External Experts:

- • Prof. Manoj Kumar Harbola — Department of Physics, IIT Kanpur
- • Dr. Rohit Medwal — Department of Physics, IIT Kanpur

Internal Members:

- • Prof. R. K. Dwivedi — Director, School of Basic Sciences (Chairman)
- • Prof. P. S. Dobal — Department of Physics, VSSD College,
- • Dr. Anju Dixit — Department of Physics, School of Basic Sciences,
- • Prof. Namita Tiwari — Department of Mathematics, School of Basic Sciences,
- • Dr. Shikha Shukla — Department of Physics, School of Basic Sciences
- • Dr. Prabal Pratap Singh — Department of Physics, School of Basic Sciences
- **Special Invitees:**
- • Dr. Awanish Kumar Bajpeyi — Department of Physics, School of Basic Sciences
- • Dr. Anjani Kumar — Department of Physics, School of Basic Sciences
- • Dr. Suresh Kumar Sharma — Department of Physics, School of Basic Sciences
- • Dr. Ram Janma — Department of Physics, School of Basic Sciences

3. Key Curriculum Revisions & Features

Based on the valuable suggestions received from the external experts, the syllabus was revised with the following key features:

- **Specialized Focus:** The curriculum was designed as a specialized M.Sc. in Quantum Technology programme, clearly distinguishing it from the conventional M.Sc. Physics curriculum and focusing on emerging areas of quantum science and technology.
- **Early Computational Foundation:** A course on 'Scientific Programming and Computational Tools' was introduced in the first semester to equip students with essential computational and programming skills from the very beginning of the programme.
- **Institutional Collaboration:** Elective courses from IIT Kanpur were incorporated in the third and fourth semesters to provide students with exposure to advanced and contemporary topics, thereby strengthening academic collaboration and enhancing learning opportunities.
- **Professional Development:** A course on 'Scientific Communication and Professional Skills' was introduced in the fourth semester to develop students' competencies in scientific writing, research communication, technical presentations, and other professional skills essential for academic and research careers.

4. Resolutions Passed by the Board

After detailed deliberations, the Board unanimously resolved that:

1. **Curriculum Approval**: The proposed M.Sc. Quantum Technology (Two-Year Programme) curriculum consisting of 100 credits distributed over four semesters is approved.
2. **Framework Approval**: The Programme Outcomes, Programme Specific Outcomes, Programme Educational Objectives, semester-wise curriculum, laboratory courses, research project, internship, and evaluation scheme are approved.
3. **IIT Kanpur Collaboration**: The Board approves the inclusion of elective courses from IIT Kanpur and recommends continuation of academic collaboration with IIT Kanpur for teaching, electives, and research.
4. **Implementation Framework**: The Board recommends that the approved syllabus be implemented from the Academic Session 2026–27, subject to approval by the Academic Council and the competent authorities of the University.

5. Board Signatures & Endorsements

Name	Signature
Prof. Manoj Kumar Harbola (External Expert)	
Dr. Rohit Medwal (External Expert)	
Prof. R. K. Dwivedi (Director/Chairman)	
Prof. P. S. Dobal (Internal Member)	
Dr. Anju Dixit (Internal Member)	Anju Dixit
Prof. Namita Tiwari (Internal Member)	14/07/26
Dr. Shikha Shukla (Internal Member)	
Dr. Prabal Pratap Singh (Internal Member)	14/7

Special Invitees (Acknowledgment of Presence):

- • Dr. Awanish Kumar Bajpeyi 14/7/26.
- • Dr. Anjani Kumar 14/07/2026
- • Dr. Suresh Kumar Sharma 14 July/2026
- • Dr. Ram Janma

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DEPARTMENT OF PHYSICS,
SCHOOL OF BASIC SCIENCES,
CSJM UNIVERSITY, KANPUR

M.Sc. QUANTUM TECHNOLOGY

(2 years duration)

Program Outcomes of M.Sc. (Quantum Technology),

Upon successful completion of the M.Sc. in Quantum Technology programme, graduates will be able to:

1. **Advanced Knowledge and Understanding:**
   Demonstrate comprehensive knowledge and understanding of fundamental and advanced concepts in Quantum Technology, Physics, Mathematics, and related interdisciplinary areas.
2. **Research Competence:**
   Develop the ability to design, conduct, analyze, and interpret research investigations using modern scientific methodologies and advanced experimental/computational techniques.
3. **Specialized Expertise:**
   Acquire specialized knowledge through dissertation/project work in emerging areas of Quantum Technology, enabling engagement in cutting-edge research and innovation.
4. **Critical Thinking and Problem Solving:**
   Apply analytical reasoning, critical thinking, and quantitative skills to identify, formulate, and solve complex scientific and technological problems.
5. **Innovation and Knowledge Creation:**
   Create, apply, and disseminate knowledge that contributes to scientific advancement, technological innovation, and societal development at regional, national, and international levels.
6. **Technical and Professional Skills:**
   Utilize modern scientific instruments, computational tools, quantum simulation techniques, and data-analysis methods relevant to academia, research laboratories, and industry.
7. **Independent and Collaborative Work:**
   Successfully undertake advanced scientific tasks and projects independently as well as collaboratively in multidisciplinary and interdisciplinary teams.
8. **Lifelong Learning:**
   Develop intellectual curiosity, self-learning abilities, and adaptability to continuously update knowledge in rapidly evolving areas of Quantum Science and Technology.
9. **Communication and Leadership:**
   Communicate scientific concepts, research findings, and technical information effectively to both specialist and non-specialist audiences while demonstrating leadership qualities.
10. **Ethics, Sustainability, and Social Responsibility:**
    Uphold professional ethics, environmental consciousness, and social responsibility, contributing towards sustainable development and responsible technological advancement.
11. **Global Competence:**
    Enhance regional, national, and international competitiveness through advanced scientific training, preparing for careers in higher education, research organizations, quantum industries, and public administration.

Program Educational Objectives (PEOs)

The M.Sc. in Quantum Technology programme is designed to achieve the following educational objectives:

PEO 1: Advanced Scientific Knowledge

Provide students with a strong foundation in Quantum Technology and related areas of Physics, enabling them to acquire advanced theoretical, computational, and experimental knowledge in emerging scientific domains.

PEO 2: Research and Innovation

Prepare graduates to undertake research and innovation in frontier areas of quantum science and technology by developing critical thinking, analytical reasoning, and problem-solving abilities.

PEO 3: Technical and Experimental Competence

Develop technical expertise through advanced laboratory training, computational methods, quantum simulations, electronics, lasers, and modern experimental techniques relevant to quantum technologies.

PEO 4: Interdisciplinary Skills

Equip students with the ability to integrate concepts from Physics, Mathematics, Computer Science, Electronics, and Engineering for solving complex scientific and technological challenges.

PEO 5: Professional Excellence

Prepare students for successful careers in academia, research laboratories, industries, government organizations, and emerging quantum technology sectors by enhancing their technical, communication, and leadership skills.

PEO 6: Research Dissertation and Project-Based Learning

Enable students to develop independent research capabilities through dissertation work, fostering scientific inquiry, data analysis, innovation, and integrative problem-solving skills.

PEO 7: Higher Education and Competitive Examinations

Prepare graduates for higher studies and research through qualification in national and international competitive examinations such as NET, CSIR-UGC NET, GATE, SLET, JEST, and other research fellowship examinations.

PEO 8: Lifelong Learning and Ethical Responsibility

Instill a commitment to lifelong learning, professional ethics, environmental sustainability, and social responsibility, enabling graduates to contribute effectively to scientific and societal advancement.

PEO 9: Global Competitiveness

Develop globally competent professionals capable of contributing to advancements in quantum computing, quantum communication, quantum sensing, quantum materials, and allied technologies at national and international levels.

PEO 10: Career Readiness

Provide opportunities for employment and research careers in higher education institutions, research laboratories, strategic sectors, and technology-driven industries, including organizations such as DRDO, BARC, ISRO, NTPC, VECC, SINP, IITs, NITs, national laboratories, and emerging quantum technology enterprises.

M.Sc. in Quantum Technology

(2 Year duration)

Semester-wise Course Structure

First Year				**Second Year**			
Ist Semester		**2nd Semester**		**3rd Semester**		**4th Semester**	
Paper/Type	Credit	Paper/Type	Credit	Paper/Type	Credit	Paper/Type	Credit
Classical Mechanics Theory/Core	4	Introduction of Quantum Materials & Devices Theory/Core	4	Atomic & Molecular Physics	4	Computational Physics and Simulation for Quantum Technology Theory/Core	4
Mathematical Methods Theory/Core	4	Quantum Mechanics-II Theory/Core	4	Quantum Optics Theory/Core	4	**Elective-2 IITK Electives	4
Quantum Mechanics-1 Theory/Core	4	Classical & Quantum Information System Theory/Core	4	Introduction to Quantum Cryptography Theory/Core	4	Scientific Communication and Professional Skills	2
Optics and Electromagnetism Theory/Core	4	Introduction to Quantum Computing Theory/Core	4	**Elective-1 IITK Electives	4		
Scientific Programming & Computational tools	2						
Laboratory-I	4	Laboratory-II	4	Laboratory-III	4		-
Research Project	-	Research Project	8	Research Project	-	Research Project	16
				Quantum Projects/ Internship/Review Based on Literature survey/ Seminar & Entrepreneurship*	4		
Total credits	22		28		24		26
Minimum Credits Annually	**50**			**50**			

Total Marks: 2200, Total Credits:100

Semester-I, Total Marks: 600, Credit:22

Sl.No.	Course Code	Course Type	Name of Paper	Maximum mark	Credit
1.	B290701T	Core	Classical Mechanics	100	4
2.	B290702T	Core	Mathematical Methods	100	4
3.	B290703T	Core	Quantum Mechanics-1	100	4
4.	B290704T	Core	Optics and Electromagnetism	100	4
5.	B290705T	Core	Scientific Programming and Computational Tools	100	2
6.	B290706P	Practical	Laboratory-I	100	4
7.			Research Project	-	-

Semester-II, Total Marks:600, Credit:28

Sl. No.	Course Code	Course Type	Name of Paper	Maximum mark	Credit
8.	B290801T	Core	Introduction of Quantum Materials & Devices	100	4
9.	B290802T	Core	Quantum Mechanics-II	100	4
10.	B290803T	Core	Classical & Quantum Information System	100	4
11.	B290804T	Core	Introduction to Quantum Computing	100	4
12.	B290805P	Practical	Laboratory-II	100	4
13.	B290806R	Project	Research Project	100	8

Semester-III, Total Marks: 600, Credit:24

Sl. No.	Course Code	Course Type	Name of Paper	Maximum mark	Credit
14.	B290901T	Core	Atomic & Molecular Physics	100	4
15.	B290902T	Core	Quantum Optics	100	4
16.	B290903T	Core	Introduction to Quantum Cryptography	100	4
17.	B290904T	Elective	Elective-1 (IITK Electives)	100	4
18.	B290905P	Practical	Laboratory-III	100	4
19.			Research Project	-	-
20.	B290906I	Internship	Quantum Projects/ Internship/Review based on literature survey/ Seminar & Entrepreneurship	100	4

Semester-IV, Total Marks:400, Credit: 26

Sl. No.	Course Code	Course Type	Name of Paper	Maximum mark	Credit
21.	B2901001T	Core	Computational Physics and Simulations for Quantum Technology	100	4
22.	B2901002T	Elective	Elective-2 (IITK Electives)	100	4
23.	B2901003T	Core	Scientific Communication and Professional Skills	100	2
24.	B2901004R	Project	Research Project	100	16

Elective -1 and Elective -2 : IIT K Electives

Course Code	IITK Course Code	Name of Paper
B290EAT	PHY643	Coherence and Quantum Entanglement
B290EBT	PHY627	Computational Simulation Methods in Physics
B290ECT	PHY656	Superconductivity and Applications
B290EDT	PHY664	Photonics Devices
B290EET	PHY675	Novel Phases of Quantum Matter
B290EFT	PHY676	Quantum Technology
B290EGT	PHY678	Nanomagnetism, Spintronics, and Applications
B290EHT	PHY692	Measurement Techniques

Resaerch Project Topics

Quantum Computing

Quantum Communication

Quantum Materials

Quantum Sensors

Quantum Cryptography

Quantum AI

Semiconductor Quantum Devices

Start-up and Innovation in Quantum Technology

Semester I (M.Sc. Quantum Technology)

Course Name: Classical Mechanics **Credit: 4** **Marks :100**

Course Code: B290701T

Course Objectives:

CO1	This paper enables the students to understand the Lagrangian and Hamiltonian approaches in classical Mechanics.
CO2	The classical background of quantum mechanics and get familiarized with Poisson brackets and Hamilton- Jacobi equation
CO3	Lagrangian and Hamiltonian formulation of classical mechanics, Hamiltonian Jacobi theory
CO4	Theory of small oscillations in detail along with basis of free vibrations.
CO5	Understanding of computational problems and simulations related to classical mechanics

Course Details:

Unit I- Review of Newtonian mechanics: Constraints, D' Alembert's principle, Generalized coordinates, Lagrange's equation, Gyroscopic forces (motion in B -field), Dissipative systems, gauge invariance, Generalized momenta, Symmetries of space and time with conservation laws, invariance under Galilean transformations.
Unit II- Central forces: definition and characteristics, Two body problems, General analysis of orbits, Kepler's laws and equation, closure and stability of circular orbits, Rutherford scattering.
Unit III- Hamiltonian equations: Principal of least action, derivation of equation of motion, Variation and end points, Hamilton principle and characteristic functions.
Unit IV- Canonical transformations: generating functions, Properties, infinitesimal generators, Poisson Brackets, Poisson theorems, Angular momentum Poisson brackets.
Unit V- Hamilton-Jacobi theory & Transition to quantum mechanics: Hamilton Jacobi Equation, Harmonic oscillator and Kepler's problem by Hamilton-Jacobi method, Action angle variables, Hamilton Jacobi Equation-Geometrical optics & wave mechanics
Unit VI- Problem of Small oscillations: Examples of two coupled oscillators, General theory of normal coordinates and normal modes of vibration.

Assignment:

- Develop a Python/MATLAB program to compare Newtonian and Lagrangian formulations of projectile motion. Plot trajectory, velocity, and energy.
- Simulate planetary motion under an inverse-square force. Plot elliptical, parabolic, and hyperbolic orbits by varying total energy and angular momentum. Verify Kepler's laws numerically.
- Simulate the motion of a charged particle in a uniform magnetic field using numerical integration. Plot cyclotron/helical trajectories for different initial conditions.
- Numerically solve two coupled oscillators and determine normal modes and normal frequencies. Compare analytical and numerical results.

Text and Reference Book:

1. Classical Mechanics by H.Goldstein, 2E, Narosa Publishing House, Delhi 2018.
2. Classical Mechanics by N.C. Rana and P.S. Joag, Tata McGraw-Hill , New Delhi, 2001.
3. Classical Mechanics by J.C. Upadhyaya, 3E, Himalaya Publishing House, Mumbai, 2022
4. Classical Mechanics of Particles and Rigid Bodies by K.C. Gupta, 3E, New Age International Ltd, New Delhi, 2018.

Semester I (M.Sc. Quantum Technology)

Course Name: Mathematical Methods **Credit:4** **Marks: 100**

Course Code: B290702T

Course Objectives:

CO1	Understand the fundamental concepts of vector calculus, matrices, determinants, and complex variables used in physical sciences.
CO2	Apply differential and integral calculus, linear algebra, and vector analysis to solve mathematical problems encountered in physics.
CO3	Analyze ordinary differential equations and employ analytical techniques to obtain solutions relevant to physical systems.
CO4	Develop proficiency in using mathematical tools such as Fourier series, Laplace transforms, and special functions for modeling physical phenomena.
CO5	Enhance analytical, logical, and problem-solving skills by applying mathematical methods to a wide range of scientific and engineering applications.

Course Details:

Unit I-Elements of complex analysis: Analyticity, Cauchy-Riemann condition, Singularities, Cauchy's theorem and integral formula, calculus of residues.

Unit II- Second order linear differential equation: Series solution of Bessel, Legendre, Laguerre and Hermits equations, Generating functions, Recurrence relations and Ortho-normal properties, Green function.

Unit III- Fourier series and Integral transforms: Fourier Series of even and odd function, fourier sine and cosine integrals, Laplace transform, Inverse Laplace transform, its properties and applications, Laplace transform of Dirac delta function, Fourier transform and inverse Fourier transform, their properties and applications.

Unit IV- Introduction to Indian Knowledge Systems (IKS) and scientific traditions. Ancient Indian concepts of space, time, matter (Paramanu), and causality; comparison with modern physics.

Contributions of Vaisheshika philosophy to atomic concepts. Indian mathematical heritage: Zero, decimal number system, Pi (π), and selected Vedic Mathematics techniques. Contributions of Aryabhata, Brahmagupta, and Bhaskara to astronomy and mathematics.

Ancient Indian astronomy: Earth's rotation, eclipses, planetary motion, and Bharatiya Kal-Ganana (Indian calendar system). Scientific heritage and technology: Agastya battery and selected contributions to metallurgy and engineering.

Assignment :

- Plot complex functions (e.g., (z^2), (e^z), (sin z)) using domain coloring or contour plots. Locate and classify singularities and verify Cauchy's integral theorem numerically.
- Generate and plot **Bessel, Legendre, Laguerre, and Hermite polynomials/functions** using Python/MATLAB. Verify recurrence relations and orthogonality numerically.
- Compute Fourier series approximations of square and sawtooth waves. Perform numerical Fourier and Laplace transforms of selected functions and compare analytical and numerical results.
- Solve a second-order differential equation numerically using Green's function or numerical ODE solvers and compare with the analytical solution.
- Implement algorithms based on **Vedic Mathematics** for rapid arithmetic and compare computational efficiency with conventional methods; alternatively, implement numerical approximations of π and discuss historical Indian methods.

Text and Reference Books:

1. Mathematical Methods for Physicists by G.Arfken and H.Weber, 6E, Elsevier Academic Press 2005.
2. Advanced Engineering Mathematics by E. Kreyszig, 10E, John Wiley & Sons Inc. 2011.
3. Mathematical Physics by H. K. Dass, 1E, S Chand & Company 1997.
4. India's Glorious Scientific Tradition by Suresh Soni, Ocean Books Pvt. Ltd, 2010.

Semester I (M.Sc. Quantum Technology)

Course Name: Quantum Mechanics-I **Credit:4** **Marks:100**

Course Code: B290703T

Course Objectives:

CO1	Students will able to understand basics of quantum mechanics.
CO2	Both Schrodinger and Heisenberg formulations of time development and their applications.
CO3	Linear vector spaces, Hilbert space, concepts of basis and operators and bra and ket notation.
CO4	Able to understand Poisson bracket and commutator.
CO5	Given idea of Pauli exclusion principle.

Course Details:

Unit I- Failure of classical physics and the emergence of quantum mechanics. Wave-particle duality of matter and radiation; experimental evidence. De Broglie matter waves: wavelength, phase velocity, group velocity, and wave packets. Principle of Superposition: Linear superposition of quantum states, probability amplitudes, interference of matter waves, and significance in quantum technologies

Unit II- Schrödinger Wave Equation: Time-dependent Schrödinger equation, Time-independent Schrödinger equation, Physical interpretation of the wave function, normalization, probability density, expectation values, and operators. Applications of Schrödinger Equation: Particle in a one-dimensional infinite potential well. Three-dimensional infinite potential well (quantum box). Quantization of energy and degeneracy. Brief introduction to quantum confinement in nanoscale systems. Heisenberg's Uncertainty Principle: Position-momentum and energy-time uncertainty relations., Wave packet interpretation. Applications to atomic stability, zero-point energy, electron confinement, and quantum nanostructures

Unit III- Dimension and basis of vector space: Hilbert space, Dirac bra-ket notation, equation, State vectors (kets), orthogonality, basis states, and probability amplitudes. Connection between superposition and qubits (conceptual introduction). Equations of motion, observables and operator, Eigen values and Eigen vectors of an operator.

Unit IV- Matrix representation of operators: solution of one-dimensional harmonic oscillator by operator method, unitary transformations, Dirac delta function Postulate of QM values expectation values and their time evolution Poisson bracket and commutator.

Unit V- Identical Particles: Symmetric and anti-Symmetric wave functions, Pauli exclusion principle, collision of identical particles.

Assignment:

- Simulate interference of two coherent matter waves.
- Visualize probability density resulting from superposition of two wave functions.

Text and Reference Book:

1. Quantum Mechanics Theory and Applications by A. Ghatak and S. Lokanathan, 5E, Macmillan, 2004.
2. A Textbook of Quantum Mechanics by P.M. Mathews and K. Venkatesan, 2E, McGraw-Hill Education (India) Pvt Limited, 2010.
3. Quantum Mechanics Concepts & Applications by N. Zettili, 2E, John Wiley & Sons Inc. 2009.
4. Quantum Mechanics by L.I. Schiff, 4E McGraw-Hill Education (India) Pvt Limited, 2017.
5. Introduction to Quantum Mechanics by D.J.Griffiths, 3E, Cambridge University Press 2018.
6. Quantum Mechanics by J.L.Powell and B.Crasemann, Addison-Wesley, 1961.
7. Quantum Mechanics by E.Merzbacher, 3E, John Wiley & Sons Inc. 2011.

A.Dixit

Semester I (M.Sc. Quantum Technology)

Course Name: Optics & Electromagnetism **Credit:4** **Marks:100**

Course Code: B290704T

Course Objectives

CO1	Explain the basic principles of wave optics and electromagnetic theory.
CO2	Analyze interference, diffraction, polarization, and optical fiber systems.
CO3	Apply Maxwell's equations to simple electromagnetic problems.
CO4	Understand the optical and electromagnetic principles underlying modern quantum technologies.

Course Details:

Unit I: Fundamentals of Wave Optics

Nature of light and wave propagation, Interference and coherence, Young's double-slit experiment, Diffraction: Fresnel and Fraunhofer diffraction, Diffraction grating and resolving power, Introduction to lasers

Unit II: Polarization and Optical Materials

Polarization of light and polarized optical components, Dispersion and optical properties of materials, Optical fibers: principles and types, Basic laser systems and applications, Introduction to photonics and optical communication

Unit III: Electrostatics and Magnetostatics

Vector calculus for electromagnetism (gradient, divergence, curl), Coulomb's law and Gauss's law, Electric potential and electric field, Electric dipoles, Biot–Savart law and Ampère's law, Magnetic field and magnetic dipoles, Motion of charged particles in electric and magnetic fields

Unit IV: Electromagnetic Waves

Faraday's law and electromagnetic induction, Maxwell's equations, Electromagnetic wave equation, Energy transport and Poynting vector, Interaction of electromagnetic waves with matter, Applications of electromagnetism in quantum technologies

Assignment:

- Simulate Young's double-slit interference pattern for different slit separations and wavelengths.
- Simulate diffraction grating intensity distribution.
- Simulate plane-polarized, circularly polarized, and elliptically polarized light.

Text Books and References:

1.Electrodynamics: David J. Griffiths
2.Vector Analysis: M. R. Spiegel
3.Optics: Ajoy Ghatak
4.A textbook of OPTICS: Subrahmanyam, Brijlal and Avadhanulu
5.Classical electrodynamics: J. D. Jackson
6.Fiber optics: Jeff Hecht

Semester I (M.Sc. Quantum Technology)

Course Name: Scientific Programming and Computational Tools **Credit:2** **Marks: 100**
Course Code: B290705T

Course Objectives

CO1	To introduce the basic concepts of computer, algorithm and programming.
CO2	To understand the concepts of scientific programming and the computational software commonly used in physics and quantum technology.

Course Details:

Unit I: Introduction to Scientific Computing: Basic structure and functioning of computer, input output devices, operating system, computer languages, Introduction to scientific computing and its applications in physics and quantum technology, Basic concepts of algorithms and flowcharts, Variables, data types, operators, expressions, input/output, conditional statements, loops, and functions.

Unit II: MATLAB and Python

Introduction to MATLAB and Python environments, Basic programming syntax, Vectors, matrices and arrays, Basic mathematical operations, Plotting graphs and simple data visualization. Introduction to scientific libraries in Python (NumPy and Matplotlib).

Unit III: Mathematica and Maple

Introduction to Mathematica and Maple, Symbolic computation, Algebraic simplification, Differentiation and integration, Matrix operations and equation solving, Basic plotting and visualization.

Unit IV: Applications in Physics

Matrix calculations in physics, Solution of simple algebraic and differential equations, Graphical representation of functions, Simple computational problems related to quantum mechanics, Overview of computational tools used in quantum technology.

Assignment:

- Draw flowcharts for solving simple scientific problems.
- Develop programs to calculate the area and volume of standard geometrical objects.
- Matrix addition, multiplication, transpose, inverse, and determinant using MATLAB
- Generate histograms, scatter plots, and contour plots using MATLAB
- Simulate probability density for a particle in a one-dimensional box.
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Reference Books

1. Steven C. Chapra – Applied Numerical Methods with MATLAB for Engineers and Scientists, McGraw-Hill Education.
2. Delores M. Etter – Engineering Problem Solving with MATLAB, Pearson Education.
3. John H. Mathews and Kurtis D. Fink – Numerical Methods Using MATLAB, Pearson.
4. Mark Newman – Computational Physics, CreateSpace Independent Publishing Platform.
5. Nicholas J. Giordano and Hisao Nakanishi – Computational Physics, Pearson.
6. R. H. Landau, M. J. Páez and C. C. Bordeianu – Computational Physics: Problem Solving with Python, Wiley-VCH.
7. Paul Wellin – Programming with Mathematica: An Introduction, Cambridge University Press.
8. Stephen Wolfram – The Mathematica Book, Wolfram Media.
9. André Heck – Introduction to Maple, Springer.

Semester I (M.Sc. Quantum Technology)

Laboratory I **Credit:4** **Marks:100**
Course Code: B290706P

List of Experiments:

1. Measurement of refractive index using Michelson interferometer
2. Determination of wavelength using Newton's Rings.
3. Study of diffraction using single slit and double slit.
4. Resonance in LCR circuits.
5. Python programming and scientific computing.
6. Matrix and complex-number operations using NumPy.
7. Quantum state representation and visualization.
8. AR-VR Simulation Lab

Semester II (M.Sc. Quantum Technology)

Course Name: Introduction of Quantum Materials & Devices **Credit:4 Marks: 100**
Course Code: B290801T

Course Objectives:

CO1	Explain the electronic structure of quantum materials.
CO2	Analyze semiconductors, superconductors, and magnetic materials used in quantum technologies.
CO3	Understand the physics of graphene, TMDs, and other 2D materials and Describe topological phases of matter and their technological significance
CO4	Explain Josephson junctions and superconducting quantum devices. Understand material growth and characterization techniques used in quantum hardware development.
CO5	Relate material properties to applications in quantum computing, communication, and sensing.

Course Details:

Unit I: Fundamentals of Quantum Materials

Crystal structures and crystal lattices, Unit cell and crystal symmetry, Reciprocal lattice, (introductory), Electrons in solids, Energy band theory, Metals, semiconductors and insulators, Direct and indirect band gap semiconductors, Introduction to quantum materials.

Unit II: Semiconductor Quantum Structures and Magnetism

Semiconductor heterostructures, Quantum wells, Quantum wires (introductory), Quantum dots, Electronic and optoelectronic devices for quantum technologies, Fundamentals of magnetism, Diamagnetism, Paramagnetism, Ferromagnetism, Antiferromagnetism, Hall effect and magnetoresistance (introductory)

Unit III: Superconductivity and Quantum Devices

Introduction to superconductivity, Zero electrical resistance, Meissner effect, Critical temperature, magnetic field, and current, Cooper pairs (qualitative introduction), Josephson effect (DC and AC), Superconducting Quantum Interference Device (SQUID), Superconducting qubits (introductory), Applications of superconductivity in quantum computing

Unit IV: Emerging Quantum Materials and devices

Introduction to graphene, Few-layer graphene, Transition metal dichalcogenides (introductory), Basic concepts of topological materials, Applications in quantum photonics, sensing, and nanoelectronics, Thin-film growth techniques (overview), Materials characterization, X-ray diffraction (XRD), Electron microscopy (SEM/TEM overview), Optical spectroscopy (overview), Thin-film deposition (overview), Lithography (introductory), Characterization techniques, Electron microscopy (overview), Electrical characterization (introductory), Emerging quantum devices, Quantum memories (overview), Hybrid quantum systems (introductory), Future applications of quantum devices

Assignment:

- Simulate crystal planes and Miller indices.
- Generate reciprocal lattice vectors for simple crystal systems.
- Simulate energy levels of a semiconductor quantum well.

Text and Reference books:

1. Introduction to Solid State Physics – Charles Kittel.
2. Solid State Physics – Neil Ashcroft & N. David Mermin.
3. Quantum Theory of Solids – Charles Kittel.
4. Topological Insulators and Topological Superconductors – B. A. Bernevig &
5. T. Hughes.
6. Quantum Computation and Quantum Information – Michael Nielsen & Isaac Chuang.

Semester II (M.Sc. Quantum Technology)

Course Name: Quantum Mechanics-II **Credit:4** **Marks:100**

Course Code: B290802T

Course Objectives

CO1	The primary goal of this course is to develop an understanding of some of the more advanced topics and techniques used in quantum mechanics.
CO2	The candidate able to understand the knowledge about Fundamental concepts and the mathematical formalism used in the general formulation of quantum mechanics (QM)

Course Details:

Unit I- Approximation method for stationary states: Perturbation theory (non degenerate and degenerate case), Variational method.

Unit II- Angular Momentum: Matrix representation, Eigen function and Eigen value 0f Lx and L2' operators, solution. of Schrodinger equation. for spherically symmetric potentials, Hydrogen atom, spin angular momentum, spin 1/2 and Pauli matrices, total angular momentum, addition of two angular moments, Clebsch -Gordan coefficients.

Unit III- Time-dependent perturbation theory: Fermi golden rule, Harmonic Perturbation.

Semi-classical theory of radiation: Transition probability for absorption and induced emission (stimulated), Electric dipole approximation, Selection rules, Forbidden transitions. Transition probability for spontaneous emission Einstein's A and B coefficients.

Assignment:

- Write a program to calculate the first-order energy correction for a particle in a one-dimensional infinite potential well using non-degenerate perturbation theory.
- Simulate the radial wave functions of the hydrogen atom.

Text and Reference books:

1. Introduction to Quantum Mechanics by D.J. Griffiths, 2E, Pearson Education, India, 2004.
2. Quantum Physics (In SI Units) BY E. Wichmann, Berkeley Physics Course Vol 4, McGraw Hill, 2017.
3. The Feynman Lectures on Physics BY Richard P. Feynman, Robert B. Leighton, Matthew Sands, Vol. 3, Pearson Education Limited, 2012.
4. A Textbook of Quantum Mechanics by P.M. Mathews and K. Venkatesan, 2E, McGraw-Hill Education (India) Pvt Limited, 2010.
5. Quantum Mechanics Concepts & Applications by N. Zettili, 2E, John Wiley & Sons Inc. 2009.
6. Quantum Mechanics by L.I. Schiff, 4E McGraw-Hill Education (India) Pvt Limited, 2017.
7. Introduction to Quantum Mechanics by D.J.Griffiths, 3E, Cambridge University Press 2018.
8. Quantum Mechanics by J.L.Powell and B.Crasemann, Addison-Wesley, 1961.
9. Quantum Mechanics by E.Merzbacher, 3E, John Wiley & Sons Inc. 2011.

Semester II (M.Sc. Quantum Technology)

Course Name: Classical and Quantum Information System: Credit:4
Marks:100

Course Code: B290803T

Course Objectives

CO1	Apply the principles of classical information theory and Calculate entropy, mutual information, and channel capacities.
CO2	Students able to understand quantum states, measurements, and quantum channels and to analyze entanglement and quantum communication protocols.
CO3	Provide understanding of quantum cryptography and quantum error correction.
CO4	Explore applications in quantum computing and quantum networks

Course Details:

Unit I: Basics of Information Theory

Information and uncertainty, Probability distributions, Shannon entropy, Joint and conditional entropy, Mutual information, Information compression (basic idea), Source coding theorem (introductory).

Unit II: Fundamentals of Quantum Information

Postulates of quantum mechanics (overview), Qubits and Bloch sphere. Pure and mixed states, Density matrix (introductory), Composite quantum systems, Tensor products, Quantum measurement.

Unit III: Quantum Entanglement and Communication

Bell states, Quantum entanglement, Entanglement as a resource, Quantum teleportation, Superdense coding, Quantum key distribution (BB84).

Unit IV: Quantum Channels, Noise and Applications

Quantum channels (basic idea), Decoherence and noise, Bit-flip and phase-flip errors (conceptual), Introduction to quantum error correction, Quantum networks and quantum internet (overview), Applications of quantum information processing.

Assignment:

- Write a program to calculate the probability distribution of a discrete information source.
- Simulate single-qubit rotations.
- Compute density matrices for pure quantum states.

Text and Reference books:

1.Quantum Computation and Quantum Information – Michael A. Nielsen & Isaac L. Chuang.
2.Elements of Information Theory – Thomas M. Cover & Joy A. Thomas.

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Semester II (M.Sc. Quantum Technology)

Course Name: Introduction to Quantum Computing **Credits: 4** **Marks:100**

Course Code: B290804T

Course Objectives

CO1	Explain the principles of quantum computation and design and analyze quantum circuits.
CO2	Implement fundamental quantum algorithms and Use quantum software tools such as Qiskit for circuit development
CO3	Understand NISQ-era quantum hardware platforms and Analyze the role of entanglement and quantum communication protocols.
CO4	Understand the basics of quantum error correction and practical quantum applications.

Course Details:

Unit I: Fundamentals of Quantum Computing

Introduction to computation, Classical vs. Quantum Computing, History and development of quantum computing, Limitations of classical computing, Applications of quantum computing, Classical bits and quantum bits (qubits), Superposition, Quantum measurement, Bloch sphere (introductory)

Unit II: Qubits and Basic Quantum Gates

Quantum states, Dirac notation (Ket and Bra notation), Computational basis states, Single-qubit state representation, Basic quantum gates: Identity (I), Pauli-X, Pauli-Y, Pauli-Z, Hadamard (H), Phase (S), Introduction to rotation gates, Simple gate operations on qubits

Unit III: Multi-Qubit Systems and Quantum Circuits

Tensor product of qubits, Two-qubit systems, Controlled gates, CNOT gate, SWAP gate, Quantum circuit model, Circuit notation, Simple quantum circuits, Bell states, Introduction to quantum entanglement

Unit IV: Introduction to Quantum Algorithms and Applications

Quantum parallelism (concept), Deutsch Algorithm, Deutsch–Jozsa Algorithm (introductory), Quantum teleportation (concept), Quantum key distribution (BB84) (concept), Applications of quantum computing, Cryptography, Optimization, Quantum chemistry, Artificial intelligence and machine learning, Future prospects of quantum computing

Assignment:

- Install and configure the Qiskit programming environment.
- Create and visualize the quantum states $|0\rangle$ and $|1\rangle$.

Text and Reference books:

1. Michael A. Nielsen and Isaac L. Chuang, Quantum Computation and Quantum Information, 10th Anniversary Edition, Cambridge University Press, 2010.
2. Eleanor G. Rieffel and Wolfgang H. Polak, Quantum Computing: A Gentle Introduction, MIT Press, 2011.
3. N. David Mermin, Quantum Computer Science: An Introduction, Cambridge University Press, 2007.
4. Jack D. Hidary, Quantum Computing: An Applied Approach, Springer Nature, 2nd Edition, 2021. Noson S. Yanofsky and Mirco A. Mannucci, Quantum Computing for Computer Scientists, Cambridge University Press, 2008.

Semester II (M.Sc. Quantum Technology)

Laboratory II **Credit:4** **Marks:100**

Course Code: B290805P

List of Experiments

1. Measurement of inductance and capacitance and study of LCR series and parallel
2. I-V characteristics of Silicon controlled rectifier
3. I-V characteristics of Uni-junction transistor
4. MOSFET characteristics.
5. Visualization of XRD/NMR via AR-VR Lab.
6. Solving problems using MATLAB and PYTHON.

Semester III (M.Sc. Quantum Technology)

Course Name: Atomic and Molecular Physics Credit:4 Total Marks:100

Course Code: B290901T

Course Objectives:

CO1	Understand the atomic structure and atomic spectra, including fine structure, Zeeman and Stark effects, and angular momentum coupling schemes.
CO2	Analyze atomic and molecular energy levels and the transitions responsible for different spectroscopic phenomena.
CO3	Explain the origin and characteristics of molecular spectra, with emphasis on rotational, vibrational, infrared, and Raman spectroscopy.
CO4	Develop an understanding of spectroscopic techniques used for the characterization and structural analysis of atoms and molecules.
CO5	Recognize the applications of atomic and molecular spectroscopy in modern physics, materials science, and emerging quantum technologies.

Course Details:

Unit I- Atomic Spectra: Quantum States of an electron in an atom, Hydrogen Spectrum, Spin-orbit interaction and fine structure, Term symbols, equivalent and non-equivalent electrons, spectra of alkali elements, Normal and anomalous Zeeman effect, Paschen-Back effect, Stark effect, LS and JJ Couplings, hyperfine structure, line broadening mechanisms

Unit II- Molecular Spectra: Types of molecules, diatomic, linear, symmetric top, asymmetric top and spherical top molecules, Microwave Spectroscopy- Rotational spectra of diatomic molecules (rigid and non rigid rotor model), microwave spectrometer

Unit III- Infrared Spectroscopy- Vibrational Spectra, Diatomic molecule as a simple harmonic and anharmonic oscillator, energy levels and infrared spectra, molecule as vibrating rotor, P, Q and R branches, IR spectra of polyatomic systems

Unit IV- Raman effect and Raman spectra, Principle of mutual exclusion, Structure determination using Raman spectroscopy, Comparison of IR, Raman, and NMR techniques. Introduction to Artificial Intelligence (AI) in Spectroscopy: AI-assisted spectral analysis, pattern recognition, spectral classification, molecular identification, and applications in materials characterization and quantum technology (overview).

Assignment:

- Simulate the hydrogen emission spectrum (Lyman, Balmer, Paschen series).
- Simulate spin–orbit splitting of atomic energy levels.
- Simulate the Normal Zeeman effect and plot spectral line splitting.

Text and Reference books:

1. Introduction to Atomic Spectra by H.E. White, McGraw Hill, 1934
2. Fundamentals of Molecular Spectroscopy by, C.N. Banwell, E.M. McCash, 4E, McGraw Hill, 2017.
3. Introduction to Molecular Spectroscopy by G.M.Barrow, McGraw Hill, 1962.
4. Modern Physics by R Murugeshan, Kiruthiga Sivaprasath, 18E, S. Chand Publishing, 2019
5. Elements of Spectroscopy by S.L. Gupta, V. Kumar, R.C. Sharma, 27E, Pragati Prakashan, Meerut, 2015.

Semester III (M.Sc. Quantum Technology)

Course Name: Quantum Optics **Credit:4** **Marks:100**

Course Code: B290902T

Course Objectives:

CO1	Develop understanding of the quantization of the electromagnetic field, photon concept, and coherence theory.
CO2	Analyze quantum states of light including Fock, coherent, squeezed, and entangled states, with emphasis on photon statistics and correlations.
CO3	Study light–matter interaction models such as the Jaynes–Cummings framework, cavity QED, and Rabi oscillations, along with experimental techniques in quantum optics.
CO4	Explore applications of quantum optics in communication, sensing, metrology, and quantum computing, including the role of Artificial Intelligence in simulation, tomography, and optimization of quantum optical systems.

Course Details:

Unit I – Foundations and Coherence

Quantization of the electromagnetic field; creation and annihilation operators; photon concept; transition from classical optics to quantum description; coherent and incoherent sources; lasers as quantum optical systems; first order coherence and interference phenomena; Michelson interferometer; second order coherence and intensity correlation functions; photon statistics; photon bunching and antibunching; Hanbury Brown–Twiss experiment.

Unit II – Quantum States of Light

Fock states and photon number distributions; coherent states and their properties; squeezed states and quadrature noise reduction; entangled photon pairs; generation via parametric down conversion; Bell's inequality tests; applications in quantum communication and computation.

Unit III – Light–Matter Interaction and Experimental Techniques

Spontaneous and stimulated emission; semi classical radiation theory; Jaynes–Cummings model of atom–field interaction; cavity quantum electrodynamics in strong and weak coupling regimes; Rabi oscillations; population inversion; quantum lasers; single photon sources including SPDC and quantum dots; photon detection techniques using photodiodes, avalanche detectors, and superconducting devices; optical interferometry with Mach–Zehnder and Michelson setups; quantum tomography of optical states; optical fibre systems for quantum communication.

Unit IV – Applications and AI in Quantum Optics

Quantum key distribution protocols (BB84, E91); squeezed light techniques for precision sensing; quantum metrology and interferometric measurements; optical clocks; photonic qubits in quantum computing architectures; role of Artificial Intelligence in quantum optics including machine learning approaches for photon statistics and coherence analysis, AI assisted optimization of interferometric setups and cavity QED experiments, deep learning methods for quantum state tomography, and applications in quantum communication security and error correction.

Text and Reference Books:

1. Marlan O. Scully & M. Suhail Zubairy – Quantum Optics, Cambridge University Press, 1st Edition, 1997.
2. Leonard Mandel & Emil Wolf – Optical Coherence and Quantum Optics, Cambridge University Press, 1st Edition, 1995.
3. Rodney Loudon – The Quantum Theory of Light, Oxford University Press, 3rd Edition, 2000.
4. Mark Fox – Quantum Optics: An Introduction, Oxford University Press, 2nd Edition, 2010.
5. Christopher Gerry & Peter Knight – Introductory Quantum Optics, Cambridge University Press, 1st Edition, 2005.
6. David J. Griffiths – Introduction to Quantum Mechanics, Cambridge University Press, 3rd Edition, 2018.
7. Selected review articles and recent research papers on AI applications in Quantum Optics.

A. Dixit

Semester III (M.Sc. Quantum Technology)

Course Name: Introduction to Quantum Cryptography **Credit:4** **Marks:100**

Course Code: B290903T

Course Objectives:

CO1	Understand the basic principles of classical and quantum cryptography and the need for quantum-secure communication.
CO2	Develop a conceptual understanding of quantum principles such as superposition, measurement, entanglement, and the no-cloning theorem.
CO3	Study the working of Quantum Key Distribution (QKD) protocols, including BB84, B92, and E91.
CO4	Explore the role of entanglement in secure quantum communication, teleportation, superdense coding, and quantum networks.
CO5	Gain an overview of practical applications of quantum cryptography, including eavesdropping detection, post-quantum cryptography, the quantum Internet, and India's National Quantum Mission.

Course Details:

Unit I: Fundamentals of Cryptography

Introduction to cryptography, Goals of cryptography: confidentiality, integrity, authentication, and non-repudiation, classical cryptography, symmetric-key cryptography, asymmetric-key cryptography, limitations of classical cryptography, Introduction to quantum cryptography, Quantum principles used in cryptography, qubits, Superposition, quantum measurement, no-cloning theorem.

Unit II: Quantum Key Distribution

Introduction to Quantum Key Distribution (QKD), security based on quantum mechanics, BB84 protocol, B92 protocol (introductory), Quantum Bit Error Rate (QBER), Basic concepts of information reconciliation, Privacy amplification (overview) .

Unit III: Entanglement and Quantum Communication

Quantum entanglement, Bell states, EPR paradox (introductory), Ekert (E91) protocol, Quantum teleportation, Superdense coding, Introduction to quantum repeaters and quantum networks.

Unit IV: Practical Quantum Cryptography and Applications

Eavesdropping and basic attack strategies, Intercept–resend attack, man-in-the-middle attack (conceptual), Error detection in QKD (overview), Single-photon sources and detectors (introductory), Optical fiber and free-space quantum communication (overview), Applications of quantum cryptography, Future directions, quantum internet (overview) post-quantum cryptography (introductory), National Quantum Mission.

Assignment:

- Compare classical and quantum cryptographic communication using simple simulations.
- Simulate the BB84 Quantum Key Distribution protocol.

Text and Reference books:

1. Quantum Computation and Quantum Information – Michael A. Nielsen and Isaac L. Chuang, Cambridge University Press, 10th Anniversary Edition, 2010. *(Standard reference for quantum information and quantum cryptography.)*

2. Introduction to Quantum Cryptography, Cambridge University Press (Lecture Notes/Introductory Reference).

3. The CODE BOOK, The science of Secrecy from Ancient Egypt to Quantum Cryptography by Simon Singh

Semester III (M.Sc. Quantum Technology)

Laboratory III **Credit:4** **Marks:100**

Course Code: B290905P

List of Experiments

1. Zeeman effect experiment.
2. B-H curve of a ferromagnetic material.
3. Measurement of resistivity of semiconductor by four probe method and determination of band gap.
4. Measurement of Hall coefficient of given semiconductor to estimate charge carrier.
5. AR-VR Simulation lab.
6. Simulation of superconducting qubits using Qiskit.
7. Quantum gate implementation on IBM Quantum processors.
8. Simulation of trapped-ion quantum systems.
9. Quantum circuit design and execution.
10. Study of decoherence effects in qubits.
11. Quantum hardware benchmarking.
12. Photonic quantum circuit simulation.
13. Mini-project on comparative analysis of quantum hardware platforms.
14. Simulation of quantum measurement processes.
15. Study of interferometric fringes using computational tools.
16. Simulation of Ramsey interferometry.
17. Quantum noise and uncertainty analysis.
18. Atomic clock performance modeling.
19. Magnetometry using spin systems (simulation).
20. NV-center-based sensing simulations.
21. Mini-project on quantum sensing applications.

Software Tools

Python
Qiskit
QuTiP
Cirq
IBM Quantum Experience

Semester IV (M.Sc. Quantum Technology)

Course Name: Computational Physics and Simulation for Quantum Technology

Credit:4 **Marks :100**

Course Code: B2901001T

Course Objectives

CO1	Understand the Fundamentals of Computational Physics
CO2	Perform Numerical Methods for Physical Systems
CO3	Perform Computational Methods in Quantum Mechanics
CO4	Perform Programming and Quantum Simulation

Course Details:

Unit I: Fundamentals of Computational Physics

Introduction to computational physics and scientific computing. Floating-point arithmetic, numerical errors, accuracy, precision, and stability. Matrix algebra and computational linear algebra, Solution of linear systems: Gaussian elimination and iterative methods. Eigenvalue and eigenvector problems: Power method and Jacobi method. Applications to quantum mechanical operators and Hamiltonian matrices.

Unit II: Numerical Methods for Physical Systems

Numerical solution of nonlinear equations: Bisection, Newton–Raphson, and Secant methods, Interpolation and curve fitting, Numerical differentiation and numerical integration. Euler and Runge–Kutta methods for ordinary differential equations, Introduction to finite-difference methods for simple boundary value problems. Applications to wave equations and the Schrödinger equation.

Unit III: Computational Methods in Quantum Mechanics

Matrix representation of quantum states and operators, Numerical solution of the time-independent Schrödinger equation, Particle in a box and harmonic oscillator simulations. Time evolution of quantum states (conceptual introduction), Quantum tunneling and wave packet.

Unit IV: Programming and Quantum Simulation

Concept of quantum simulation. Introduction to open-source quantum simulation tools (QuTiP/Qiskit) at a conceptual level. Applications of computational methods in quantum computing, quantum communication, quantum sensing, and quantum materials.

Assignment:

- Solve systems of linear equations using Gaussian elimination by using programming.
- Solve nonlinear equations using the Bisection method by using programming.
- Represent qubits computationally.
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Text Books and References:

1. Donald A. McQuarrie, *Mathematical Methods for Scientists and Engineers*, University Science Books, 2003.
2. Susan M. Lea, *Mathematics for Physicists*, Brooks/Cole (Cengage Learning), 2004.
3. Richard Courant and David Hilbert, Methods of Mathematical Physics, Volumes I & II, Wiley-VCH.

Semester IV (M.Sc. Quantum Technology)

Course Name: Scientific Communication and Professional Skills

Credit:2 **Marks:100**

Course Code: B2901003T

Course Objectives:

CO1	To develop effective oral and written communication skills.
CO2	To improve scientific, technical writing for quantum technology and Enhance presentation, interpersonal communication abilities.

Course Details:

Unit I: Fundamentals of Communication:

Communication process and models Verbal and non-verbal communication, Listening skills and feedback, Barriers to communication and overcoming them, Interpersonal and professional communication

Unit II: Scientific and Technical Writing:

Principles of technical writing, Email and professional correspondence, Report writing, Research abstract and synopsis writing Scientific vocabulary and grammar, Referencing styles and avoiding plagiarism.

Unit III: Oral Communication and Presentation Skills:

Public speaking techniques, Seminar and conference presentations, Presentation design (PowerPoint/LaTeX Beamer) Poster presentation, Question handling and audience interaction.

Unit IV: Professional Communication:

Resume/CV preparation, Statement of Purpose (SOP), Group discussion, Personal interview skills, Team communication and workplace ethics, Communication in interdisciplinary research and industry, Practical Activities

Technical presentation (Individual), Scientific article review, Group discussion, Mock interview, technical report/abstract writing, Poster presentation.

Text and Reference books:

1. Sanjay Kumar & Pushp Lata – *Communication Skills*, Publisher: Oxford University Press.
2. Meenakshi Raman & Sangeeta Sharma – *Technical Communication: Principles and Practice*
3. M. Ashraf Rizvi – *Effective Technical Communication*, Publisher: McGraw-Hill Education
4. Robert A. Day & Barbara Gastel – *How to Write and Publish a Scientific Paper*, Cambridge University Press

To
The Honourable Vice Chancellor
Chhatrapati Shahu Ji Maharaj University
Kanpur

9.6.2026

Subject: Approval of Board of Studies (BoS) Committee for Design and Approval of M.Sc. in Quantum Technology Curriculum

Respected Sir,

The School of Basic Sciences proposes to convene a meeting of the **Board of Studies (BoS)** for the formulation, review, and approval of the curriculum and course structure of the newly proposed **M.Sc. in Quantum Technology** programme.

For this purpose, the following Board of Studies committee is proposed, comprising distinguished external experts and internal faculty members with expertise in Physics, Mathematics,and emerging Quantum Technologies. Your kind approval is solicited for the constitution of the BoS and nomination of the external experts.

External Experts

1. **Prof. Manoj Harbola**
   Department of Physics, IIT Kanpur
2. **Prof. Debabrata Goswami**
   Department of Chemistry + Photonics Science and Engineering, IIT Kanpur
3. **Dr. Rohit Medwal**
   Department of Physics, IIT Kanpur

Internal Members

1. **Prof. R. K. Dwivedi**
   Director, School of Basic Sciences, CSJM University, Kanpur
2. **Prof. P. S. Dobal**
   HoD, Department of Physics, VSSD College, CSJM University, Kanpur
3. **Dr. Anju Dixit**
   Associate Professor, Department of Physics & MSME
   School of Basic Sciences & UIET, CSJM University, Kanpur
4. **Dr. Namita Tiwari**
   Associate Professor Department of Mathematics and Computer Applications
   School of Basic Sciences & UIET, CSJM University, Kanpur
5. **Dr. Shikha Shukla**
   Assistant Professor & Coordinator
   Department of Physics, School of Basic Sciences, CSJM University, Kanpur

Approved

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6. **Dr. Prabal Pratap Singh**
Assistant Professor & Deputy Coordinator
Department of Physics, School of Basic Sciences, CSJM University, Kanpur

The proposed BoS shall deliberate upon and recommend the programme structure, syllabus, course contents, credit framework, and other academic aspects of the M.Sc. in Quantum Technology programme in accordance with NEP-2020 and the latest developments in the field.

Therefore, it is requested that the constitution of the above Board of Studies and the nomination of the external experts may kindly be approved.

Thanking you.

Yours faithfully,

Anju Dixit.

Dr. Anju Dixit
Associate Professor
Department of Physics & MSME
Deputy Director
School of Basic Sciences
CSJM University, Kanpur

09/06/26

Special Invitee :

1. Dr. Awanish Kumar Bajpeyi, Department of Physics, SBS, CSJM University, Kanpur.
2. Dr. Anjani Kumar, Department of Physics, SBS, CSJM University, Kanpur.
3. Dr. Suresh Kumar Sharma, Department of Physics, SBS, CSJM University, Kanpur.
4. Dr. Ram Janma, Department of Physics, SBS, CSJM University, Kanpur.