Anekant Education Society's

TULJARAM CHATURCHAND COLLEGE OF ARTS, SCIENCE AND COMMERCE, BARAMATI

(Autonomous Status)

(Affiliated to Savitribai Phule Pune University, Pune)

Faculty of Science

Department of Physics

Proposed Syllabus

For

M.Sc. in Physics

Semester-I

2019 PATTERN

From Academic Year 2019-2020

Anekant Education Society's

TULJARAM CHATURCHAND COLLEGE OF ARTS, SCIENCE AND COMMERCE, BARAMATI

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M.Sc.-I
Semester-I Course Structure

Course Number	Course Code	Course Name	Credit
1	PHY4101	Mathematical Methods in Physics	4
2	PHY4102	Classical Mechanics	4
3	PHY4103	Quantum Mechanics-I	4
4	PHY4104	Electronics	4
5	PHY4105	Electronics Laboratory-I	4
6	PHY4106	Basic Physics Laboratory-I	4
Total Credit			**24**

Programme Outcomes (POs)

PO1	**Disciplinary Knowledge:** Demonstrate comprehensive knowledge of the discipline that forms a part of a postgraduate Programme. Execute strong theoretical and practical understanding generated from the specific Programme in the area of work.
PO2	**Critical Thinking and Problem solving:** Exhibit the skill of critical thinking and understand scientific texts and place scientific statements and themes in contexts and also evaluate them in terms of generic conventions. Identify the problem by observing the situation closely, take actions and apply lateral thinking and analytical skills to design the solutions.
PO3	**Social competence:** Exhibit thoughts and ideas effectively in writing and orally; communicate with others using appropriate media, build effective interactive and presenting skills to meet global competencies. Elicit views of others, present complex information in a clear and concise way and help reach conclusions in group settings.
PO4	**Research-related skills and Scientific temper :** Infer scientific literature, build a sense of enquiry and able to formulate, test, Analyse, interpret and establish hypothesis and research questions; and to identify and consult relevant sources to find answers. Plan and write a research paper/project while emphasizing on academics and research ethics, scientific conduct and creating awareness about intellectual property rights and issues of plagiarism.
PO5	**Trans-disciplinary knowledge:** Create new conceptual, theoretical and methodological understanding that integrates and transcends beyond discipline-specific approaches to address a common problem.
PO6	**Personal and professional competence:** Perform independently and also collaboratively as a part of a team to meet defined objectives and carry out work across interdisciplinary fields. Execute interpersonal relationships, self-motivation and adaptability skills and commit to professional ethics.
PO7	**Effective Citizenship and Ethics:** Demonstrate empathetic social concern and equity centered national development, and ability to act with an informed awareness of moral and ethical issues and commit to professional ethics and responsibility.
PO8	**Environment and Sustainability:** Understand the impact of the scientific solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
PO9	**Self-directed and Life-long learning:** Acquire the ability to engage in independent and life-long learning in the broadest context of socio-technological changes.

SYLLABUS (CBCS) FOR M.Sc. PHYSICS (w.e.f. June, 2019)

Academic Year 2019-2020

Class : M. Sc. (Semester- I)

Paper Code : PHY-4101

Paper : I **Title of Paper : Mathematical Methods in Physics**

Credit : 4 credits **No. of lectures: 60**

PHY4101: MATHEMATICAL METHODS IN PHYSICS

Course outcomes:

After completion of the course, the student should be able to:

CO 1. From this course, the students are expected to learn some mathematical techniques required to understand the physical phenomena at the postgraduate level.

CO 2. The students are expected to be able to solve simple problems in probability, understand the concept of independent events and work with standard continuous distributions.

CO 3. The students will have idea of the functions of complex variables; solve nonhomogeneous differential equations and partial differential equations using simple methods.

CO 4. The students are expected to be able to solve simple problems on Fourier series and Fourier transform, Laplace transform etc.

CO: Students have a good grasp of the basic elements of complex analysis, including the important integral theorems.

CO7: Students are able to apply variational calculus to find optimal curves and surfaces

CO8: Problem solving ability

Unit 1: Matrix Algebra **(15L)**

Introduction, Matrix representation, Rank of matrix, Similarity transformations, Eigen values and eigenvectors, Inner product, Orthogonality, Gramm-Schmidt orthogonalization procedure, Self adjoint and Unitary transformations, Eigen values & eigenvectors of Hermitian & Unitary transformations, Diagonalization, Problem Solving

Unit 2: Basic Mathematical Methods and Linear vector spaces **(15L)**

Introduction, Plotting of graph, curve fitting, data analysis, Elementary probability theory, random variables, binomial, Poisson and normal distributions, Calculus: vector algebra and vector calculus. Linear algebra. Elementary complex analysis. Vector spaces and subspaces, Linear dependence and independence, Basis and Dimensions, linear operators, Problem Solving

Unit 3: Fourier series and Integral transforms **(15L)**

Introduction, Fourier Series : Linear differential equations, Definition, Dirichlet's condition, Convergence, Fourier Integral and Fourier transform, Convolution theorem, Parseval's identity, Applications to the solution of differential equations, Laplace transform and its properties, Fourier transform & Laplace transform of Dirac Delta function, Introduction to Gamma and Beta Integral, Problem Solving

Unit 4: Complex Analysis **(15L)**

Introduction, Elements of complex analysis: residues and evaluation of integrals; Introduction & types of tensors, Introductory group theory. Elements of computational techniques: roots of functions, interpolation, extrapolation, integration by trapezoid and Simpson's rule, solution of first ODE using Runge-Kutta method; Finite difference methods, Problem Solving.

Reference Books:

1. Complex Variables and Applications – J. W. Brown, R. V. Churchill – (7th Edition) - Mc-Graw Hill
2. Complex Variables – Seymour Lipschutz
3. Mathematics for Physical Sciences – Mary Boas, John Wiley & Sons
4. Mathematical methods in Physics – B. D. Gupta
5. Linear Algebra – Seymour Lipschutz, Schaum Outlines Series- Mc-Graw Hill edition
6. Matrices and Tensors in Physics, A. W. Joshi, 3rd Edition, New Age International
7. Mathematical methods for Physicists – Arfken & Weber – 6th Edition-Academic Press- N.Y.
8. Mathematical methods in Physics – Satyaprakash

9. Fourier Series - Seymour Lipschutz, Schaum Outlines Series
10. Laplace Transform - Seymour Lipschutz, Schaum Outlines Series 11. Fourier Series and Boundary value problems - R. V. Churchill, McGraw Hill
11. Mathematical Physics, Rajput, Pragati prakashan
12 Mathematical Physics, H. K. Dass

Mapping of Program Outcomes with Course Outcomes

Course Outcomes	**Programme Outcomes**								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**3**								
CO2		**2**							
CO3				**2**					
CO4	**3**								
CO5	**3**								
CO6		**3**							
CO7		**3**							

Justification

CO 1: From this course, the students are expected to learn some mathematical techniques required to understand the physical phenomena at the postgraduate level.
PO1: Disciplinary Knowledge (Weightage: 3)
Justification: This CO directly supports PO1 by providing the mathematical techniques necessary to comprehend physical phenomena, aligning with the acquisition of disciplinary knowledge.

CO 2: The students are expected to be able to solve simple problems in probability, understand the concept of independent events, and work with standard continuous distributions.
PO2: Critical Thinking and Problem Solving (Weightage: 2)
Justification: Solving problems in probability, understanding independent events, and working with continuous distributions requires some level of critical thinking and problem-solving, albeit at a moderate or partial level.

CO 3: The students will have an idea of the functions of complex variables; solve nonhomogeneous differential equations and partial differential equations using simple methods.

PO4: Research-related Skills and Scientific Temper (Weightage: 2)
Justification: Solving nonhomogeneous differential equations and partial differential equations using simple methods involves research-related skills and aligns partially with the development of a scientific temper in PO4.

CO 4: The students are expected to be able to solve simple problems on Fourier series and Fourier transform, Laplace transform, etc.
PO1: Disciplinary Knowledge (Weightage: 3)
Justification: This CO directly contributes to PO1 by focusing on mathematical tools such as Fourier series and transforms necessary to comprehend physical phenomena.

CO 5: Students have a good grasp of the basic elements of complex analysis, including the important integral theorems.
PO1: Disciplinary Knowledge (Weightage: 3)
Justification: This CO emphasizes understanding complex analysis, which directly aligns with PO1's emphasis on disciplinary knowledge.

CO 6: Students are able to apply variational calculus to find optimal curves and surfaces.
PO2: Critical Thinking and Problem Solving (Weightage: 3)
Justification: This CO involves applying calculus concepts to problem-solving, directly aligning with the development of critical thinking and problem-solving skills in PO2.

CO 7: Problem-solving ability
PO2: Critical Thinking and Problem Solving (Weightage: 3)
Justification: This CO explicitly focuses on problem-solving, aligning directly with PO2.

CO 8: Problem-solving ability
PO2: Critical Thinking and Problem Solving (Weightage: 3)
Justification: Similar to CO 7, this CO also concentrates on problem-solving abilities, directly aligning with PO2.

SYLLABUS (CBCS) FOR M.Sc. PHYSICS (w.e.f. June, 2019)

Academic Year 2019-2020

Class : M. Sc. (Semester- I)

Paper Code : PHY-4102

Paper : I **Title of Paper : CLASSICAL MECHANICS**

Credit : 4 credits **No. of lectures: 60**

PHY4102: CLASSICAL MECHANICS

Credit: 04 **No. of Lectures: 60**

Learning outcomes:

After completion of the course, the student should be able to:

CO1: The students will introduce about the newton's laws of motion and knowledge about the applications of newton's laws of motion.

CO2: This paper enables the students to understand the Langrangian approach in classical mechanics.

CO3: The students should be able to understand Hamiltonian formulation with applications

CO4: The paper also enables the students to know about variational principle with applications.

CO5: The students should be able to understand central forces and types of central forces in detail, ideas regarding equations of orbit and deduction of Kepler's laws.

CO6: Students learn about motion of a particle under central force field.

CO7: Students learn about Lagrangian and Hamiltonian formulation of Classical Mechanics.

CO8: Problem solving ability

CO9: Critical analysis

Unit 1: Constrained Motion and Langrangian formulation (15 L)

Constrained Motion, Constraints and their Classification**,** Degrees of freedom, generalized coordinates, Virtual Displacement, Principle of Virtual Work, D'Alembert Principle, Configuration space, Lagrange's equation of motion, Theorem on total energy, Cyclic coordinates, Generalized momenta, Invariance under Galilean transformation.

Problems solving

Unit 2: Hamilton's formulation & Variational Principle **(15 L)**

Hamilton's function and Hamiltonian equation of motion, Phase space, Jacobi integrals and energy conservation, Langrangian and Hamiltonian of relativistic particles and light rays, Variational principle, Euler's equation,

Applications of Variational principle, Concept of symmetry.

Problems solving

Unit 3: Canonical Transformations and Poisson's Bracket **(15 L)**

Introduction- Background and definition, Legendre transformations, Generating function, Conditions for canonical transformation, Poisson's bracket-definition, identities, Poisson's theorem, Jacobi Poisson theorem, Jacobi identity, Invariance of Poisson Bracket under canonical transformation.

Problems solving

Unit 4: Central Force **(15 L)**

Introduction, definition and properties of Central Force, Two body central force problem, Stability of orbit, Orbits of artificial satellite, Keplers problem, Inertial forces in rotating frame, Coriolis force and its effect, Foucault's pendulum, Virial theorem.

Problems solving

Reference Books:

1. Classical mechanics by J.C. Upadhyaya, Himalaya Publishing House.
2. Classical mechanics by N.C. Rana and P.S. Joag, Tata Mc-Graw Hill Publishing Company limited, New Delhi.
3. Classical Mechanics by P.V. Panat, Narosa publishing Home, New Delhi.
4. Classical Mechanics by Kumar, Gupta, Sharma.
5. Classical Mechanics by H. Goldstein, Narosa Publishing Home, New Delhi.
6. Classical Mechanics by D. S. Mathur.
7. Introduction to Classical Mechanics by R. G. Takawale and P. S. Puranik, Tata Mc-Graw Hill Publishing Company Limited, New Delhi.
8. Classical Dynamics of Particles and Systems by Marion and Thomtron, Third Edition,

Horoloma Book Jovanovich College Publisher.

9. Analytical Dynamics E.T. Whittaker, Cambridge, University Press.

Mapping of Program Outcomes with Course Outcomes

Course Outcomes	Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**3**								
CO2		**2**		**3**					
CO3				**3**					
CO4				**3**	**2**				
CO5		**3**			**2**				
CO6		**2**				**2**			
CO7						**2**			

Justification

PO1: Disciplinary Knowledge
CO1: Weightage - 3
Justification: Newton's laws of motion and their applications are fundamental to disciplinary knowledge in physics, directly aligning with PO1.

PO2: Critical Thinking and Problem-solving
CO5: Weightage - 3
Justification: Problem-solving ability, as emphasized in CO8, directly aligns with critical thinking and problem-solving skills outlined in PO2.
CO6: Weightage - 2
Justification: Critical analysis, although not explicitly mentioned in PO2, significantly contributes to critical thinking skills, albeit at a moderate or partial level.

PO4: Research-related Skills and Scientific Temper
CO2: Weightage - 3
Justification: Understanding the Langrangian approach in classical mechanics requires research-related skills and contributes to developing a scientific temper as specified in PO4.

CO3: Weightage - 3
Justification: Understanding Hamiltonian formulation and its applications directly involves research-related skills and aligns strongly with developing a scientific temper.
CO4: Weightage - 3

Justification: Knowing about variational principles and their applications significantly contributes to research-related skills and scientific temperament.

PO5: Trans-disciplinary Knowledge
CO5: Weightage - 2
Justification: Understanding central forces, equations of orbits, and Kepler's laws, although more focused on classical mechanics, contributes partially to trans-disciplinary knowledge by integrating physics concepts.

PO6: Personal and Professional Competence
CO6: Weightage - 2
Justification: Learning about the motion of a particle under a central force field contributes moderately to personal and professional competence by enhancing understanding in a specific area of physics.
CO7: Weightage - 2
Justification: Understanding Lagrangian and Hamiltonian formulations in classical mechanics also contributes partially to personal and professional competence by enhancing expertise in a specific domain.

SYLLABUS (CBCS) FOR M.Sc. PHYSICS (w.e.f. June, 2019)

Academic Year 2019-2020

Class : M. Sc. (Semester- I)

Paper Code : PHY-4103

Paper : I **Title of Paper : QUANTUM MECHANICS- I**

Credit : 4 credits **No. of lectures: 60**

PHY4103: QUANTUM MECHANICS- I

Learning outcomes:

After completion of the course, the student should be able to:

CO 1: Understanding Quantum Concepts: Students should comprehend the basic principles and postulates of quantum mechanics, including wave-particle duality, superposition, and quantization of energy.

CO 2: Solving Schrödinger Equation: Ability to solve the time-independent Schrödinger equation for various one-dimensional potentials and understand its physical significance.

CO 3: Quantum Operators and Observables: Mastery in applying and manipulating operators, understanding their properties, and predicting quantum observables.

CO 4: Quantum Mechanical Systems: Analyzing quantum systems such as harmonic oscillator, particle in a box, and potential barriers to understand their behavior using quantum principles.

CO 5: Quantum States and Wavefunctions: Understanding and interpreting wavefunctions, probability density, and the physical interpretation of the wave function squared.

CO 6: Angular Momentum in Quantum Mechanics: Understanding the quantization of angular momentum and its consequences, including the spherical harmonics and their importance.

CO 7: Identifying Symmetry in Quantum Systems: Recognizing symmetries in quantum systems and understanding their consequences on quantum states and observables.

CO 8: Introduction to Approximation Methods: Familiarity with perturbation theory, variational principle, and other approximation methods used in solving quantum mechanical problems.

Unit 1: Revision and general formalism **(15 L)**

Revision: Why QUANTUM MECHANICS?

Introduction, Inadequacy of classical Physics, wave packets and uncertainty relations, Schrodinger wave equation and probability interpretation, Simple one dimensional problems: potential well, potential barrier and simple harmonic oscillator (1-D, 3-D), Applications of Schrodinger steady state equation: Free particle, Particle in infinitely deep potential well, Barrier penetration and tunnelling effect (1-D, 3-D), Particle in three dimension rigid box, Step potential. Spherically symmetric potentials: Schrodinger's equation in spherical polar co-ordinate system. Rigid rotator, Hydrogen atom, Problem solving.

Formalism of quantum mechanics:

Hilbert space and wave function: The linear Vector Space, Hilbert's Space, Dimension and Basis of vector Space, Square Integral Functions: Wave functions, Dirac's bra and ket notation, **Dynamical variables and linear operators:** projection operators, unit operator, unitary operator, matrix representation of an operator: Change of basis, unitary transformation, Adjoint and self adjoint operators, eigen functions and eigen values, degeneracy, Dirac delta function, Completeness and closure property, Physical interpretation of eigen values, eigen functions and expansion coefficients, Eigen values and Eigen functions of momentum operator. Eigen values and Eigen functions of simple harmonic oscillator by operator method.

Unit 2: Postulates of quantum mechanics: **(15 L)**

Basic Postulates of Quantum Mechanics: The state of System: Probability density, The superposition principle, Observables and operators: Measurement in **Quantum Mechanics**, Time Evolution of the System's State, Symmetries and Conservation Laws, Connecting Quantum Mechanics to Classical Mechanics.

Unit 3: Angular Momentum **(15 L)**

Orbital Angular Momentum, General formalism of Angular Momentum, Matrix representation of Angular Momentum, Geometrical Representation of Angular Momentum, Spin Angular Momentum, Eigen function of Angular Momentum: Eigen values and eigen functions of L^2 and L_z operators, ladder operators L_+ and L_- (Harmonic Oscillator), Pauli's theory of spins (Pauli's matrices) , matrix representation of J in |jm> basis. Rotations in Quantum Mechanics:

Infinitesimal rotations, finite rotations, properties of rotations, Eular rotations, Representation of rotation operator, Rotation matrices and Spherical harmonics. Addition of angular momenta: general formalism, Computation of Clebsch-Gordon coefficients in simple cases (J1= $\frac{1}{2}$, J2 = $\frac{1}{2}$), Scalar, Vector and Tensor operator, Wigner-Eckart Theorem.

Unit 4: Approximation Methods (15 L)

Time-independent Perturbation theory: Non degenerate and degenerate perturbation, Stark effect, anharmonic oscillator, Zeeman Effect, Time dependent Perturbation theory: Transition amplitude 1^{st} and 2^{nd} order, Introduction to WKB approximation, Variational method: Basic principles and applications to particle in box, simple harmonic oscillator.

Reference Books:

1. Quantum Mechanics by Nouredine Zettili, A John Wiley and Sons, Ltd.
2. Modern Quantum Mechanics by J. J. Sakurai.
3. A Textbook of Quantum Mechanics by P. M. Mathews and K. Venkatesan.
4. Quantum mechanics by A. Ghatak and S. Lokanathan.
5. Quantum Mechanics by L. I. Schiff.
6. Quantum Physics by R. Eisberg and R. Resnick.
7. Introduction to Quantum Mechanics by by David J. Griffiths.
8. Introductory Quantum mechanics by Granier, Springer Publication.
9. Introductory Quantum Mechanics by Li boff, 4^{th} Edition, Pearson Education Ltd.
10. Principles of Quantum Mechanics by Shankar R. II^{nd} Edition (Plenum, 1994).

Mapping of Program Outcomes with Course Outcomes

Course Outcomes	Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**3**								
CO2	**2**	**3**							
CO3	**2**	**3**							
CO4				**3**					
CO5									
CO6						**2**			
CO7					**2**				

Justification

PO1: Disciplinary Knowledge
CO1: Weightage - 3
Justification: Understanding quantum concepts is fundamental to disciplinary knowledge in physics, directly aligning with the acquisition of knowledge in quantum mechanics.
CO2: Weightage - 2
Justification: Solving the Schrödinger equation for various potentials contributes partially to disciplinary knowledge by applying theoretical concepts to practical problems.
CO3: Weightage - 2
Justification: Mastery in quantum operators and observables contributes partially to disciplinary knowledge by applying mathematical formalism in quantum mechanics.

PO2: Critical Thinking and Problem-solving
CO2: Weightage - 3
Justification: Solving the Schrödinger equation and understanding its physical significance involves high-level critical thinking and problem-solving skills, directly aligning with PO2.
CO3: Weightage - 3
Justification: Manipulating operators, predicting quantum observables, and solving quantum problems require critical thinking skills, aligning strongly with PO2.

PO4: Research-related Skills and Scientific Temper

CO4: Weightage - 3
Justification: Analyzing quantum systems using quantum principles involves research-related skills and contributes to developing a scientific temper.
Justification: Introduction to approximation methods contributes partially to research-related skills by employing methods used in quantum research.

PO5: Trans-disciplinary Knowledge
CO7: Weightage - 2
Justification: Identifying symmetries in quantum systems and understanding their consequences contributes partially to trans-disciplinary knowledge by relating physics principles to broader theoretical concepts.

PO6: Personal and Professional Competence
CO6: Weightage - 2
Justification: Understanding angular momentum quantization and its consequences contributes partially to personal and professional competence by enhancing expertise in a specific area of physics.

SYLLABUS (CBCS) FOR M.Sc. PHYSICS (w.e.f. June, 2019)

Academic Year 2019-2020

Class : M. Sc. (Semester- I)

Paper Code : PHY-4104

Paper : I **Title of Paper : ELECTRONICS**

Credit : 4 credits **No. of lectures: 60**

PHY4104: ELECTRONICS

Learning outcomes:

After completion of the course, the student should be able to:

CO1: Manipulate voltage, current and resistances in electronic circuits.

CO2: Demonstrate familiarity with basic electronic components and use them to design simple electronic circuits.

CO3: Design and analyse of electronic circuits,

CO4: Evaluate frequency response to understand behaviour of Electronics circuits.

CO5: Problem solving ability.

CO6: Critical analysis,

CO7: Understand the fundamentals of converting from one number system to another.

Unit 1: Study and applications of Operational Amplifiers (15L)

Concept of input/output impedance, Input bias current, offset input voltage, slew rate, CMMR, Gain, frequency response, Applications of Operational Amplifiers: Inverting and Non-inverting amplifier, Adder and Substractor, Integrator and Differentiator, Active filters: LPF, HPF, BPF, and Notch filter 1st and 2nd order with designing, Instrumentation Amplifier, Function Generator – Square wave, triangular, saw tooth, sine wave. Half wave and full wave precision rectifiers, Sample and hold circuits.

Unit 2: Communication Electronics (15L)

Basic principle of amplitude, frequency and phase modulation, Simple circuits for amplitude modulation and demodulation, Digital modulation (PCM) and demodulation, Fundamentals of optical communication, Microwave Oscillators (reflex, klystron, magnetron and Gunn diode), Radio detector

Unit 3: Digital Logic circuits **(15L)**

Combinational Logic: Review of Boolean identities and its use to minimize Boolean Expressions, Minimization of Boolean Expressions using Karnaugh map: SOP and POS

Sequential Logic, Flip-flops: RS, JK, MS-JK, D and T, Shift registers using IC 7495: Applications as SISO, SIPO, PISO, PIPO, Counters: Review of synchronous, asynchronous and combinational counters, Decade counter IC 7490 with applications, Up-down counter

Unit 4: Data Converters **(15 L)**

Digital to analog Converters, Binary weighted type, R-2R ladder, Study of IC 0808, Analog to digital converters, Single slope, Dual slope, Flash/Simultaneous type, Counter type, Successive approximation type

Reference Books:

1. Operational Amplifiers – G.B.Clayton (5th edition) Newnes
2. Operational Amplifiers Applications – G.B.Clayton
3. Electronic Principles – A. P. Malvino (TMH Publication)
4. Op-amps and Linear Integrated circuits – Gayakwad (Prentice Hall)
5. Linear Integrated circuits – D.Roy Choudhury, Shail Jain
6. Integrated circuits – Botkar
7. Digital Principles and Applications : Leach and Malvino
8. Data Converters – B.S. Sonde.

Mapping of Program Outcomes with Course Outcomes

Course Outcomes	Programme Outcomes								
	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3								
CO2	3								
CO3	3								
CO4	3								
CO5		3							
CO6		3							
CO7									

Justification

PO1: Disciplinary Knowledge

CO1: Manipulate voltage, current, and resistances in electronic circuits. (Weightage: 3)
CO2: Demonstrate familiarity with basic electronic components and use them to design simple electronic circuits. (Weightage: 3)
CO3: Design and analyze electronic circuits. (Weightage: 3)
CO4: Evaluate frequency response to understand the behaviour of electronic circuits. (Weightage: 3)
Justification: These course outcomes directly align with the technical knowledge and skills related to electronic circuits, covering the fundamental aspects and application of electronics.

PO2: Critical Thinking and Problem Solving

CO5: Problem-solving ability. (Weightage: 3)
CO6: Critical analysis. (Weightage: 3)
Justification: Both CO5 and CO6 emphasize critical thinking, problem-solving, and analytical skills required in designing, analyzing, and troubleshooting electronic circuits.

SYLLABUS (CBCS) FOR M.Sc. PHYSICS (w.e.f. June, 2019)

Academic Year 2019-2020

Class : M. Sc. (Semester- I)

Paper Code : PHY-4105

Paper : I **Title of Paper : PHY4105: Electronics Laboratory-I**
Credit : 4 credits **No. of lectures: 60**

PHY4105: ELECTRONICS LABORATORY-I

(Students have to perform Any 10 Experiments)

After successfully completing this laboratory course the students will be able to do the following:

CO1: Understand mathematical description and representation of continuous and discrete time signals and systems.

CO2: Understand and resolve the signals in frequency domain using Fourier series and Fourier Transforms.

CO3: Understand the limitations of Fourier transform and need for Laplace transform and develop the ability to analyze the system in s-domain.

CO4: Understand the basic concept of probability, random variables & random signals and develop the ability to find correlation, CDF, PDF and probability of a given event.

CO5: Comply and verify parameters after exciting devices by any stated method.

CO6: Implement circuit and test the performance.

CO7: Design and analyze transformers.

CO8: Problem solving ability.

CO9: Critical Analysis.

List of Experiments

1. Voltage to Frequency Convertor using OP-AMP.
2. Diode pump using UJT.
3. DAC (4 bit R-2R Ladder Type).
4. Active filter- Low pass, High pass, Band pass and Notch Filter using OP-AMP.
5. Function generator using OP-AMP.
6. Study of optocoupler using IC- MCT2E
7. Constant current source using OP-AMP.
8. Crystal oscillator- Millar type.
9. Study of Clocked RSFF and DFF Using NOR/NAND gates.
10. Instrumental amplifier using three op-amps
11. Design, built and test oscillator – Wien Bridge oscillator
12. Study of IC 7490 (Decade counter).
13. Amplitude modulation and demodulation
14. Optical fiber communication.
15. Pulse train generator.
16. Op-amp based clipper and clampers.

Mapping of Program Outcomes with Course Outcomes

Course Outcomes	Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**3**								
CO2	**3**								
CO3	**3**								
CO4	**3**								
CO5									
CO6									
CO7	**3**								
CO8		**3**							
CO9		**3**							

Justification

PO1: Disciplinary Knowledge

CO1: Understand mathematical description and representation of continuous and discrete-time signals and systems. (Weightage: 3)

CO2: Understand and resolve the signals in the frequency domain using Fourier series and Fourier Transforms. (Weightage: 3)

CO3: Understand the limitations of Fourier transform and need for Laplace transform and develop the ability to analyze the system in s-domain. (Weightage: 3)

CO4: Understand the basic concept of probability, random variables & random signals and develop the ability to find correlation, CDF, PDF, and the probability of a given event. (Weightage: 3)

CO7: Design and analyze transformers. (Weightage: 3)

Justification: These course outcomes directly align with developing core knowledge and skills in signal processing, mathematics, probability theory, and transformer design, which are fundamental to disciplinary knowledge in electrical engineering.

PO2: Critical Thinking and Problem Solving

CO8: Problem-solving ability. (Weightage: 3)

CO9: Critical Analysis. (Weightage: 3)

Justification: CO8 and CO9 emphasize critical thinking, analytical skills, and problem-solving abilities essential in analysing signals, designing systems, and assessing performance.

SYLLABUS (CBCS) FOR M.Sc. PHYSICS (w.e.f. June, 2019)

Academic Year 2019-2020

Class : M. Sc. (Semester- I)

Paper Code : PHY-4106

Paper : I **Title of Paper : PHY 4106: Basic Physics Laboratory-I**

Credit : 4 credits **No. of lectures: 60**

PHY4106: BASIC PHYSICS LABORATORY-I

(Students have to perform Any 10 Experiments)

After successfully completing this laboratory course the students will be able to do the following:

CO 1. Understand the depth knowledge of various subjects of Physics.

CO 2. Demonstrate skills and competencies to conduct wide range of scientific experiments.

CO 3. Identify their area of interest in academic and R&D. Perform job in various fields' viz.

CO 4. To provide students a strong foundation education in Physics

CO 5. To provide structured curricula, this supports academic development of students.

CO 6. To provide and prepare the students for employment and higher studies in Physics

CO 7. To provide a good learning environment for Physics

List of Experiments

1. Young’s Modulus of steel by Flexural Vibrations of a bar
2. Fabry-Parot Etalon.
3. Hall Effect.
4. Resistivity of Ge at various temperature by Four Probe method and determination of band gap.
5. Determination of Rydberg constant.
6. Michelson Interferometer.
7. Magnetic Susceptibility by Gauoy’s method.
8. ‘e’ by Millikan oil drop method.
9. G.M. Counter – I Counting statistics
10. G.M. Counter –II End point energy and Absorption coefficient using G. M. tube.
11. Determination of Planck’s constant
12. Stefan’s constant – Black body radiation.
13. Electron Diffraction.
14. Determination of solar constant
15. Coherence and width of spectral lines using Michelson Interferometer.
16. Determination of Seebeck coefficient and understanding of Thermocouple working.

Mapping of Program Outcomes with Course Outcomes

Course Outcomes	Programme Outcomes								
	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	**3**								
CO2				**2**					
CO3				**2**					
CO4	**3**								
CO5									
CO6	**3**								
CO7	**3**								
CO8		**3**							
CO9		**3**							

Justification

PO1: Disciplinary Knowledge
CO1: Understand the depth knowledge of various subjects of Physics. (Weightage: 3)
CO4: To provide students a strong foundation education in Physics. (Weightage: 3)
CO6: To provide and prepare the students for employment and higher studies in Physics. (Weightage: 3)
CO7: To provide a good learning environment for Physics. (Weightage: 3)
Justification: These outcomes are directly related to building a solid understanding and foundation in physics, aligning well with disciplinary knowledge in the field.
PO2: Critical Thinking and Problem Solving
CO8: Problem-solving ability. (Weightage: 3)
CO9: Critical Analysis. (Weightage: 3)
Justification: CO8 and CO9 emphasize critical thinking, analytical skills, and problem-solving abilities, essential for scientific inquiry and experimentation in physics.
PO4: Research-related Skills and Scientific Temper
CO2: Demonstrate skills and competencies to conduct a wide range of scientific experiments. (Weightage: 2)
CO3: Identify their area of interest in academic and R&D. Perform jobs in various fields viz. (Weightage: 2)
Justification: CO2 and CO3 focus on research skills, experimentation, and interest identification, aligning moderately with research-related skills in physics.