Shri Vaishnav Vidhyapeeth Vishvavidhyalaya, Indore

P.G. PROGRAM M. Sc. PHYSICS

SEM-I

Paper-I: QUANTUM PHYSICS-I

SUB-JECT CODE	Catego-ry	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRAC-TICAL		Th	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
MSPH 101	DC	QUANTUM PHYSICS-I	60	20	20	0	0	3	1	0	4

Course Objectives:-

1. To develop the comprehensive understanding of laws of physics related to quantum physics and ability to apply them for laying the foundation for research and development.
2. To work ethically as member as well as leader in a diverse team.

Course Outcomes:-

1. Student will be able to understand and solve the problems related to Quantum physics.
2. Student will be able to determine physical parameter experimentally with optimal usage of resources and complete the assignments in time.

Shri Vaishnav Vidhyapeeth Vishvavidhyalaya, Indore

SYLLABUS

MSPH101 [QUANTUM PHYSICS-I]

Unit-I: Limitations of classical mechanics, origin of Quantum Mechanics, Basic postulates of Quantum Mechanics, equation of continuity, properties and physical significance of wave function, , Ehrenfest theorem, Schrödinger wave equation.

Unit-II: solution of Schrödinger wave equation for one dimensional infinite potential well and step, and bound states, solution of Schrödinger wave equation for linear Harmonic oscillator, operator algebra of harmonic oscillator.

Unit-III: Overview of linear vector spaces: Inner product space, operators, expectation values of physical variables, bases, Dirac notation, eigenvalues and eigenvectors, Completeness of eigen functions, Commutation relations.

Unit-IV: Angular momentum: Commutation relations, spin angular momentum, Pauli matrices, raising and lowering operators, L-S coupling, Total angular momentum, addition of angular momentum, Clebsch-Gordon coefficients.

Unit-V: Three dimensional problems: Solution of Schrödinger equation for free particle in spherically symmetric cavity, central potential, three dimensional harmonic oscillator, degeneracy, solution of Schrödinger equation for Hydrogen atom and its application to atomic spectra.

Text and reference books

1. L I Schiff: Quantum Mechanics (Mcgaw-Hill Book Company)
2. S Gasiorowicz: Quantum **Physics (Wiley, New York)**
3. J D Powell and B Craseman: Quantum Mechanics (Addison Wesley Publishing Company)
4. A P Messiah: Quantum Mechanics (North - Holland)
5. J J Sakurai: Modern Quantum Mechanics (Pearson Education, INC.)
6. Mathews and Venkatesan: A text book of Quantum Mechanics (Tata McGraw-Hill Publishing Company Ltd.)
7. A Ghatak & S Loknathan: Quantum Mechanics; Theory and Applications (Macmillan India Ltd.)

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Shri Vaishnav Vidhyapeeth Vishvavidhyalaya, Indore

P.G. PROGRAM M. Sc. PHYSICS

SEM-I

Paper-II: CLASSICAL MECHANICS

SUB-JECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRAC-TICAL		Th	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
MSPH 102	DC	CLASSICAL MECHANICS	60	20	20	0	0	3	1	0	4

Course Objectives:-

1. To develop the comprehensive understanding of Classical Mechanics and ability to apply them for laying the foundation for research and development.
2. To work ethically as member as well as leader in a diverse team.

Course Outcomes:-

1. Student will be able to understand and solve the problems related to Classical Mechanics.
2. Student will be able to determine physical parameter experimentally with optimal usage of resources and complete the assignments in time.

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MSPH102 [CLASSICAL MECHANICS]

UNIT-I:

Newton's laws of motion, Newton's equation of motion, constraints definition and their classification, D'Alembert's principle in Generalized coordinates; The Langrange's equations. Generalized momenta and Langrangian formulation of conservation theorem.

UNIT-II:

Rotating frames; Inertial forces; Coriolis force Definition, terrestrial and astronomical applications of Coriolis force, Conservation laws: Symmetries of space and time with conservation laws, The equation of motion and first integrals of motion.

UNIT-III:

The central force problem: Definition and characteristics, Two-body problem, Reduction to the equivalent One Body Problem, The equivalent One-dimensional problem and classification of orbits, Kepler's laws: Kepler's first, Second and third law, Applications of Keplers's law: Artificial satellites.

UNIT-IV:

The Hamiltonian function, Hamilton's equation of motion, Hamilton's principle, Modified Hamilton's principle, δ-variation, Derivation of Hamilton's equation from Variational principle, Principle of least action.

UNIT-V:

Canonical transformation; generating functions; definition and classification, Poisson bracket and their properties, invariance of poisson bracket with respect to canonical transformation, equation of motion in poisson bracket form, Poisson theorem.

Text and Reference Books

1. N. C. Rana and P. S. Joag: Classical Mechanics (Mcgraw-Hill Education (India) (P) Ltd.)
2. H. Goldstein: Classical Mechanics (Narosa Publishing House, New Delhi)
3. A. Sommerfeld: Mechanics (Lectures on theoretical Physics Vol.1, Acadmic Press)
4. I. Peroceival and D. Richards: Introduction to Dynamics (Cambridge University Press)
5. J. C. Upadhyaya: Classical Mechanics (Ramprasad and Sons)

P.G. PROGRAM M. Sc. PHYSICS

SEM-I

Paper-III: APPLIED ELECTRONICS

SUB-JECT CODE	Cat-egory	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRAC-TICAL		Th	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
MSPH103	DC	APPLIED ELECTRONICS	60	20	20	0	0	3	1	0	4

Course Objectives:-

1. To develop the comprehensive understanding of laws of physics related to Applied Electronics and ability to apply them for laying the foundation for research and development.
2. To work ethically as member as well as leader in a diverse team.

Course Outcomes:-

1. Student will be able to understand and solve the problems related to Applied Electronics.
2. Student will be able to determine physical parameter experimentally with optimal usage of resources and complete the assignments in time.

MSPH103 [APPLIED ELECTRONICS]

Unit – 1: Electronic devices: Transistors: JFET, BJT, MOSFET and MESFET: Structure, Working, V-I characteristics under different configurations. Microwave Devices: Tunnel diode, transfer electron devices (Gunn diode), Avalanche Transit time devices, Impatt diode. Devices: LED, photodiode, structure and working.

Unit – 2: Amplifiers-I: Negative feedback & its advantages in amplifiers, various types of couplings in amplifiers, RC Coupled common emitter amplifier, and its frequency response curve. Differential amplifier- Circuit configurations- dual input, balanced output differential amplifier- DC analysis- AC Analysis, inverting and non inverting inputs, CMRR constant current bias level translator.

Unit – 3: Amplifiers-II: Block diagram of a typical Op-amp with negative feedback-voltage series feedback-effect of feedback on closed loop gain input persistence output resistance bandwidth and output offset voltage-follower. CMRR frequency response. DC and AC amplifier summing scaling and averaging amplifiers instrumentation amplifier, comparators, integrator and differentiator.

Unit – 4: Oscillators: Positive feedback & Brakhausen Criteria of Oscillators, Oscillators principle and Oscillator types: frequency stability response, the phase shift oscillator, Wein bridge oscillator, LC tunable oscillators, Multivibrators: Astable, Monostable and Bistable Multivibrators-square wave and triangle wave generators.

Unit – 5: Voltage regulators- Transistorizes series pass regulator. IC regulator -fixed regulators, adjustable voltage regulators switching regulators. . Logic Gates: OR, AND, NOT, NOR, NAND Gates, NAND Gate as a universal building block.

Reference:

1. S M Sze: Semiconductor devices Physics of Semiconductor Devices, 3rd Edition American Scientific Publishers.
2. M S Tyagi: Inroduction to semiconductor devices, publisher, John Wiley & Sons.

3. M Sayer and A Mansingh: Measurement, Instrumentation and experimental design in physics and engineering, Publisher: Prentice-Hall of India Pvt.Ltd; 1 edition.
4. J Millmann and C E Halkias: Integrated electronic: Analog and Digital circuits and systems Tata McGraw - Hill Education, New Delhi.
5. Mithal G K. Electronics Devices And Circuits, Publisher, Khanna Publishers.

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P.G. PROGRAM M. Sc. PHYSICS

SEM-I

Paper-IV: MATHEMATICAL PHYSICS

SUB-JECT CODE	Catego-ry	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRAC-TICAL		Th	T	P	CREDITS
			End Sem Universi ty Exam	Two Term Exam	Teac hers Ass ess men t	End Sem Uni vers ity Exa m	Tea che rs Ass ess me nt				
MSPH 104	DC	MATHEMATICAL PHYSICS	60	20	20	0	0	3	1	0	4

Course Objectives:-

1. To develop the comprehensive understanding of laws of physics related to Mathematical & Computational Physics and ability to apply them for laying the foundation for re-search and development.
2. To work ethically as member as well as leader in a diverse team.

Course Outcomes:-

1. Student will be able to understand and solve the problems related to Mathematical & Computational Physics.
2. Student will be able to determine physical parameter experimentally with optimal usage of resources and complete the assignments in time.

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MSPH104 [MATHEMATICAL PHYSICS]

Unit –I: Dimensional analysis. Vector algebra and vector calculus. Linear algebra, Matrices, Cayley-Hamilton Theorem.

Unit –II: Bessel functions of first and second kind, Hermite, Legendre, Associate Legendre and Laguerre Polynomials,Their recursion relations, generating functions, and orthogonality.

Unit – III: Integral transforms, Fourier integral, Fourier transform and inverse Fourier transforms. Fourier transform of derivatives. Convolution theorem, Elementary Laplace transforms. Laplace transform of derivatives.

Unit – IV: Green's functions: Non-homogenous boundary value problems, Green's function for one Dimensional problems, Green's function for electrostatic boundary value problems.

Unit – V: Elementary probability theory, random variables, binomial, Poisson and normal distributions. Central limit theorem, Cauchy Riemann equations, Cauchy theorem, Cauchy integral formula, Taylors expansion and series.

References:

1. G. Arfken: Mathematical Methods for Physics Publisher: Academic Press Inc; 7th Revised edition.
2. A. W. Joshi: Matrices and Tensors for Physicists ,Publisher, New Age International, 1995.
3. E. Kreyszig: Advanced Engineering Mathematics , Publisher: Wiley; 10th Edition edition.
4. Mary L Bose: Mathematics for Physicists. , Publisher: Wiley; 3rd Edition edition.
5. Mathematics of Engineers and Physicists :Pipes, Publisher, McGraw-Hill.

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

P.G. PROGRAM M. Sc. PHYSICS

SEM –I

Paper-V: PHYSICS PRATICAL

SUB-JECT CODE	Catego-ry	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRAC-TICAL		Th	T	P	CREDITS
			End Sem Universi ty Exam	Two Term Exam	Teac hers Ass ess men t	End Sem Uni vers ity Exa m	Tea che rs Ass ess me nt				
MSPL 105	DC	Physical Practical-I	00	00	00	90	60	0	0	12	6

List of Experiments:(Any Eight)

1. Assembly of Logic gates using discrete components and to verify truth table.
2. Perform mathematical operations using OPAM as Adder, Subtractor, Divider, Multiplicator.
3. Regulated Power Supply. (Transistorized)
4. Wave shaping circuit, clipping, clamping, differentiating and integrating circuits.
5. R.C. coupled amplifier-frequency response.
6. Emitter follower.
7. FET characteristics and calibration of FET Input voltmeter
9. Measurement of Hybrid parameters of transistor.
10. Operational amplifier (OP Amp) as integrator & differentiator
12. Determination of Planck's constant by using photocell.
13. Study of Astable, Monostable and BistableMultivibrator.
14. MOSFET characterization and application as an amplifier.

Note: Other experimental set up depending upon availability in institutions, related to theory paper in corresponding semester.