U.G. PROGRAM B. Sc. Physics (Hons.)

SEM-II-Paper-I

Waves, Acoustics and Optics

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment *	End Sem University Exam	Teachers Assessment*				
BSPH 202	DC	Waves ,Acoustics and Optics	60	20	20	30	20	3	1	4	6

Legends: L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;
Q/A – Quiz/Assignment/Attendance, MST Mid Sem Test.
*Teacher Assessment shall be based on following components: Quiz/Assignment/ Project/Participation in class (Given that no component shall be exceed 10 Marks)

Course Objectives:-

1. To develop the comprehensive understanding of laws of physics related to Waves, Acoustics and Optics 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 Waves ,Acoustics and Optics
2. Student will be able to determine physical parameter experimentally with optimal usage of resources and complete the assignments in time.

BSPH 202: Waves, Acoustics and Optics

Unit-I:

Waves in Media : Speed of transverse waves on a uniform string, speed of longitudinal waves in a fluid, energy density and energy transmission in waves, typical measurements. Waves over liquid surface : gravity waves and ripples Group velocity and phase velocity, their measurements
Superposition of waves: Linear homogeneous equation and the superposition principle, non linear superposition and consequences.
Standing waves: Standing waves as normal modes of bounded systems, examples. Harmonics and the quality of sound; Chaldni's figures and vibrations of a drum . Production and detection of ultrasonic and instrasonic waves and applications.

Unit-II:

Noise and Music ; The human ear and its responses ; limits of human audibility, intensity and loudness, bel and decibel, the musical scale, temperament and musical instrument.
Reflection, refraction and diffraction of sound. Acoustic impedance of a medium, percentage reflection and refraction at a boundary, impedance matching for transducers, diffraction of sound, principle of a sonar system ranging.

Unit-III:

Applied acoustics: Transducers and their characteristics, recording and reproduction of sounds, various systems, Measurements of frequency, waveform, intensity and velocity. The acoustics of halls, reverberation period, Sabine's formula.
Fermat's Principle of extremum path, the aplantic points of a sphere and other applications. General theory of image formation: cardinal points of an optical system, general relationship, lens and lens combinations, Lagrange equation of magnification, telescopic combinations, telephoto lenses and eyepieces.

UNIT IV:

Introduction to Interference, Fresnel's Bi-prism, Interference in Thin films, Newton's rings experiment, Michelson's interferometer and its application, Introduction to Diffraction and its Types, Diffraction at single slit, double slit and diffraction grating

Unit V:

Rayleigh criterion, resolving power of grating, Concept of polarized light, Brewster's laws, Double refraction, Nicol prism, quarter and half wave plate, circularly & elliptically polarized light.

References:

1. Optics by Ajoy Ghatak, McGraw-Hill International Editions.
2. *A text book on Optics by Subrahmanyam.*
3. *Optics by Brijlal and Avadhanulu*, South Asian Publication.
4. *Concept of Physics* by H.C. Verma, Bharati Bhavan Publishers.

List of Experiments (Any Eight)

1. To determine the refractive index of the material of the prism using Na light.
2. To determine the dispersive power of the material of the prism.
3. Measurement of radius of curvature "R" of convex lens by Newton's ring experiment.
4. Measurement of Resolving Power of Telescope.
5. Measurement of "λ" of Na light source using Diffraction Grating.
6. To determine the mass of cane sugar dissolved in water using half shade polarimeter.
7. Heating efficiency of electrical Kettle with varying voltages.
8. Measurement of Resolving Power of prism.
9. Measurement of Resolving Power of grating.
10. Measurement of Frequency of A.C. mains by electrically maintained vibrating rod.

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

U.G. PROGRAM B. Sc. Physics (Hons.)

SEM-II-Paper-II

Quantum and Atomic Physics

SUBJECT CODE	Category	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
BSPHPH203	DC	Quantum and Atomic Physics	60	20	20	0	0	4	0	0	4

Course Objectives:-

- To develop the comprehensive understanding of laws of Quantum and Atomic Physics and ability to apply them for laying the foundation for research and development.
- To work ethically as member as well as leader in a diverse team.

Course Outcomes:-

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

BSPHPH203:Quantum and Atomic Physics

Unit-I Limits of Classical mechanics, Black body spectrum, Explanation of Black Body radiation: Stefan's Law, Wien's Law, Rayleigh-Jean's law, Planck's Law, Ultraviolet Catastrophe, Photoelectric effect, Compton effect, de Broglie hypothesis, Wave-particle duality, Davisson-Germer experiment, Wave packets, Group velocity and phase velocity and their relationship, Uncertainty principle and its applications.

Unit-II Quantum Mechanics Basic Postulates and Formalism :- Energy, Momentum and Hamiltonian Operators. Time-independent Schrödinger Wave Equation for Stationary States. Properties of Wave Function.Interpretation of Wave Function.Probability Density and Probability. Conditions for Physical Acceptability of Wave Functions, Normalization, Linearity and Superposition Principles,.

Unit-III Wave Mechanics; Schrodinger's wave equation: Time dependent Schrodinger's equation, Time independent Schrodinger's equation; Schrodinger equation by the method of operator, Expectation value of dynamical variables, Hermite operator and its properties, Solution of Schrodinger equation, transition probability, Eigenvalues and Eigenfunctions, Expectation Values and transition probabilities.

Unit-IV Solution of Schrodinger's equation for a free particle; free particle enclosed in a three dimensional box; reflection of a particle through a potential step (or a potential barrier of infinite width and finite hight); transmission through a rectangularpotential barrier; tunnel effect and application of barrier potential (Alfa decay), Reflection from a one dimensional potential well of finite width and depth.

Unit-V Bound State Problems :- General Features of a Bound Particle System, (1) One Dimensional Simple Harmonic Oscillator : Energy Levels and Wave Functions. Zero Point Energy, (2) Quantum Theory of Hydrogen Atom : Particle in a Spherically Symmetric Potential. Schrodinger Equation.Separation of Variables.Radial Solutions and Principal Quantum Number, Orbital and Magnetic Quantum Numbers.Quantization of Energy and Angular Momentum.Space Quantization.

Reference Books:

1. Quantum Physics: S. Gasiorowicz.

2. Quantum Mechanics: B. H. Bransden and C. J. Joachain.

3. Quantum Physics of Atoms, Molecules, Nuclei and Solids: R. M. Eisberg and R. Resnick.

4. Quantum Mechanics: V. Devanathan.

5. Quantum Mechanics: C. S. Chaddha.