Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

B. Sc. Physics Hons

VI Sem

Subject Code	Category	Subject Name	Teaching and Evaluation Scheme								
			Theory			Practical					
			End Sem University Exam	Two Term Exam	Teachers Assessment*	End Sem University Exam	Teachers Assessment*	Th	T	P	CREDITS
BSPHPH602	DC	Quantum Mechanics and Spectroscopy	60	20	20	30	20	4	1	0	5

Course Objectives	1. To develop the comprehensive understanding of laws of physics related to Quantum Mechanics and Spectroscopy 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 Ourcomes	1. Student will be able to understand and solve the problems related to Quantum Mechanics and Spectroscopy. 2. Student will be able to determine physical parameter experimentally with optimal usage of resources and complete the assignments in time.

Abbreviation		
Th	Theory	**Teacher Assessment (Theory) shall be based on following components: Quiz / Assignment/ Project / Participation in class (Given that no component shall be exceed 10 Marks).**
T	Tutorial	**Teacher Assessment (Practical) shall be based on following components: Viva / File / Participation in Lab work (Given that no component shall be exceed 50% of Marks).**
P	Practical	

Registrar
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Dr. UTTAM SHARMA
Professor & Head
Department of Physics
Shri Vaishnav Institute of Science

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

BSPHPH602 : Quantum Mechanics and Spectroscopy

UNIT I Particles and waves inadequacies in classical physics, Blackbody radiation: quantum theory of light. Photoelectric effect, Compton Effect, Wave nature of matter: de Broglie hypothesis. Wave-particle duality, Davisson-germer experiment, Wave description of particles by wave packets. Group and phase velocities and relation between them, Two-slit experiment with electrons. Probability, Wave amplitude and wave functions.

UNIT II Heisenberg's uncertainty principle (uncertainty relations involving canonical pair of variables): derivation from wave packets. Energy, momentum and Hamiltonian operators, Time-independent Schrodinger wave equation for stationary states, Properties of wave Function. Interpretation of wave function, Probability density, Conditions for physical acceptability of wave functions, Linearity and superposition Principles, Eigen values and Eigen functions

UNIT III Expectation values, Wave function of a free Particle. Applications of Schrödinger wave equation: Eigen functions and Eigen values for a particle in a one dimensional box. 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.

UNIT IV Schrodinger wave equation, Separation of variable, Radial solutions and principal quantum Number, orbital and magnetic quantum numbers, Quantization of energy and Angular Momentum, Space quantization, Electron probability Density. Finite Potential Step: Reflection and Transmission.

UNIT V Critical review of Bohr's model for monovalent valance electron, Concept of spin and Stern-Gerlach experiment, Quantum number associated with many electron system-total orbital angular momentum quantum number (L), total spin quantum number (S), total quantum number (J), multiplicity of energy level state, spectroscopic notations for energy states, spin orbit coupling, fine structure, vector atom model, normal and anomalous Zeeman effect, Raman effect.

Registrar
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Dr. UTTAM SHARMA
Professor & Head
Department of Physics
Shri Vaishnav Institute of Science

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

References

1. Quantum Mechanics: V. Devanathan, Narosa Publishing House, New Delhi, 2005
2. Quantum Mechanics: B. H. Bransden, Pearson Education, Singapore, 2005
3. Quantum Mechanics: Concepts and Applications, Nouredine Zettili, Jacksonville tate University, Jacksonville, USA, John Wiley and Sons, Ltd, 2009
4. Physics of Atoms and molecules: B.H. Bransden and C.J. Joachaim, Pearson Education, Singapore. 2003
5. Fundamentals of Molecular Spectroscopy: C.M. Banwell and M. McCash. McGraw Hill (U.K. edition).
6. Introduction to Atomic Physics, H. E. White Quantum Mechanics: Schaums Outlines, Y. Peleg, R. Pnini, E. Zaarur, E. Hecht.

Registrar
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Dr. UTTAM SHARMA
Professor & Head
Department of Physics
Shri Vaishnav Institute of Science

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

B. Sc. Physics Hons

VI Sem

Subject 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				
BSPHP H605	DC	Plasma Physics	60	20	20	0	0	4	1	0	5

Course Objectives	1. To develop the comprehensive understanding of laws of physics related to Plasma 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 Ourcomes	1. Student will be able to understand and solve the problems related to Plasma Physics. 2. Student will be able to determine physical parameter experimentally with optimal usage of resources and complete the assignments in time.

Abbreviation		
		Teacher Assessment (Theory) shall be based on following components: Quiz / Assignment/ Project / Participation in class (Given that no component shall be exceed 10 Marks).
Th	Theory	
T	Tutorial	**Teacher Assessment (Practical) shall be based on following components: Viva / File / Participation in Lab work (Given that no component shall be exceed 50% of Marks).**
P	Practical	

Registrar
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Dr. UTTAM SHARMA
Professor & Head
Department of Physics
Shri Vaishnav Institute of Science

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

BSPHPH605 : PLASMA PHYSICS

UNIT I Introduction of Plasma: Occurrence of Plasmas in Nature, Definition of Plasma, Concept of Temperature, The Saha Equation, Quasineutrality, Debye Shielding, The Plasma Parameters, Three condition for Plasmas.

UNIT II Single Particle: single particle motion, Uniform E and B Fields, Nonuniform B Field, Nonuniform E Field, Time varying E Field, Time-Varying B Field, Center Drifts, Adiabatic Invariants.

UNIT III Plasma as Fluid: Plasma as a fluid, Relation of Plasma Physics to Ordinary Electromagnetics, Fluid Equation of Motion, Fluid Drifts Perpendicular to B, Fluid Drifts Parallel to B, Plasma Approximation.

UNIT IV Diagnostics of Plasma: Single Probe Technique: Measurement of Electron Temperature and Electron Temperature of Plasma, Double Probe Technique: Measurement of Electron Temperature and Density of Plasma. Spectroscopy diagnostics.

UNIT V Application of Plasma: Material processing, Bio-medical applications: Concept of Plasma Niddle, working and recent development, plasma sterilization, plasma surface modification of polymer, corona plasma: air and water disinfection, plasma based nanofabrication, dielectric barrier discharge (DBD), plasma etching.

REFERENCES

1. J D Jackson: Classical electrodynamics (Berkley, California).
2. J A Bittencourt: Fundamentals of Plasma Physics (Springer).
3. F F Chen: Introduction to Plasma Physics (Plenum Press).

Registrar
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Dr. UTTAM SHARMA
Professor & Head
Department of Physics
Shri Vaishnav Institute of Science

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

B. Sc. Physics Hons

VI Sem

Subject Code	Category	Subject Name	Teaching and Evaluation Scheme								
			Theory			Practical		Th	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
BSPHPH603	DC	Nuclear and Particle Physics	60	20	20	0	0	4	1	0	5

Course Objectives	1. To develop the comprehensive understanding of laws of physics related to Nuclear and Particle 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 Ourcomes	1. Student will be able to understand and solve the problems related to Nuclear and Particle Physics. 2. Student will be able to determine physical parameter experimentally with optimal usage of resources and complete the assignments in time.

Abbreviation		
Th	Theory	**Teacher Assessment (Theory) shall be based on following components: Quiz / Assignment/ Project / Participation in class (Given that no component shall be exceed 10 Marks).**
T	Tutorial	**Teacher Assessment (Practical) shall be based on following components: Viva / File / Participation in Lab work (Given that no component shall be exceed 50% of Marks).**
P	Practical	

Registrar
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Dr. UTTAM SHARMA
Professor & Head
Department of Physics
Shri Vaishnav Institute of Science

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

BSPHPH603: Nuclear and Particle Physics

UNIT I General Properties of Nuclei

Constituents of nucleus and their Intrinsic properties, quantitative facts about mass, radii, charge density (matter density), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excites states.

UNIT II Nuclear Models

Liquid drop model approach, semi empirical mass formula and significance of its various terms, condition of nuclear stability, two nucleon separation energies, Fermi gas model (degenerate fermion gas, nuclear symmetry potential in Fermi gas), evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model, concept of mean field, residual interaction, concept of nuclear force.

UNIT III Radioactivity decay

Concept of half life (a) Alpha decay: basics of α-decay processes, theory of α- -decay: energyβemission, Gamow factor, Geiger Nuttall law, α-decay spectroscopy. (b) βdecay: energy kinematics for β decay, positron emission, electron capture, neutrino hypothesis. (c) β Kinematics for Gamma decay: Gamma rays emission & kinematics, internal conversion.

UNIT IV Nuclear Reactions

Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate, reaction cross section, Concept of compound and direct Reaction, resonance reaction, Coulomb scattering (Rutherford scattering), Nuclear Fission and Fusion, Linear accelerator, Cyclotron, Synchrotrons

UNIT V Particle physics

Particle interactions; basic features, types of particles and its families. Symmetries and Conservation Laws: energy and momentum, angular momentum, parity, baryon number, Lepton number, Isospin, Strangeness and charm, concept of quark model, color quantum number and gluons.

REFERENCES

1. Introductory nuclear Physics by Kenneth S. Krane (Wiley India Pvt. Ltd., 2008).

Registrar
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Dr. UTTAM SHARMA
Professor & Head
Department of Physics
Shri Vaishnav Institute of Science

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

2. Concepts of nuclear physics by Bernard L. Cohen. (Tata Mcgraw Hill, 1998).
3. Introduction to the physics of nuclei & particles, R.A. Dunlap. (Thomson Asia, 2004).
4. Introduction to High Energy Physics, D.H. Perkins, Cambridge Univ. Press.
5. Introduction to Elementary Particles, D. Griffith, John Wiley & Sons.
6. Basic ideas and concepts in Nuclear Physics - An Introductory Approach by Quarks and Leptons, F. Halzen and A.D. Martin, Wiley India, New Delhi.

Registrar
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Dr. UTTAM SHARMA
Professor & Head
Department of Physics
Shri Vaishnav Institute of Science

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Shri Vaishnav VidhyapeethVishvavidhyalaya, Indore

B. Sc. Physics Hons

VI Sem

Subject Code	Category	Subject Name	Teaching and Evaluation Scheme								
			Theory			Practical		Th	T	P	CREDITS
			End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
BSPHPH604	DC	Introduction to Optoelectronics	60	20	20	0	0	4	1	0	5

Course Objectives	1. To develop the comprehensive understanding of laws of physics related to Optoelectronics 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 Ourcomes	1. Student will be able to understand and solve the problems related to Optoelectronics. 2. Student will be able to determine physical parameter experimentally with optimal usage of resources and complete the assignments in time.

Abbreviation		
Th	Theory	**Teacher Assessment (Theory) shall be based on following components: Quiz / Assignment/ Project / Participation in class (Given that no component shall be exceed 10 Marks).**
T	Tutorial	**Teacher Assessment (Practical) shall be based on following components: Viva / File / Participation in Lab work (Given that no component shall be exceed 50% of Marks).**
P	Practical	

Registrar
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Dr. UTTAM SHARMA
Professor & Head
Department of Physics
Shri Vaishnav Institute of Science

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Shri Vaishnav VidhyapeethVishvavidhyalaya, Indore

BSPHPH604: Introduction to Optoelectronics

UNIT I Introduction to Optical sources and their properties, Optical emission from semiconductors: P-N junction diode, Heterojunction, Semiconductor materialSemiconductor injection Lasers. Efficiency and Stripe geometry.

UNIT II Light emitting diode (LED) structures: Planar LED, Dome LED, Surface emitter,Edge emitter, Superluminescent LED, LED Characteristics: Optical output power, output spectrum, reliability.

UNIT III Single mode operation, Semiconductor laser structures: Gain guided and index guided lasers, Semiconductor laser characteristic: Threshold temperature dependence, Dynamic response, Frequency chirp, noise and reliability.

UNIT IV Introduction to optical detectors, principle and types of optical detectors, Absorption: Absorption coefficient, direct and indirect absorption in Silicon (Si) and Germanium (Ge). Quantum efficiency, responsively and cutoff wavelength of optical detectors.

UNIT V Semiconductors photodiode without internal gain: p-n photo diode, p-i-n photodiode, speed of response, Basic idea of noise in optical detectors, Semiconductors photodiodes with internal gains: Avalanche photodiodes. Benefits and drawbacks of Avalanche photodiodes and Multiplication factor.

References

1. Optical Fiber Communications: Principles and practices, John M. Senior, Prentice Hall of
2. India, Pvt. Ltd.
3. Fundamental of optics, F. A. Jenkins & H. E. White, Tata McGraw hill.
4. LASERS: Fundamentals & applications, K.Thyagrajan &A.K.Ghatak Tata McGraw Hill.
5. Fibre optics through experiments, M.R.Shenoy, S.K.Khijwania, et.al., Viva Books.
6. Nonlinear Optics, Robert W. Boyd, (Chapter-I), Elsevier.
7. Optics, Karl Dieter Moller, Learning by computing with model examples, Springer.
8. Optical Systems and Processes, Joseph Shamir, PHI Learning Pvt. Ltd.

Registrar
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Dr. UTTAM SHARMA
Professor & Head
Department of Physics
Shri Vaishnav Institute of Science

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

9. Optoelectronic Devices and Systems, S.C. Gupta, PHI Learning Pvt. Ltd.

10. Optical Physics, A.Lipson, S.G.Lipson, H.Lipson, 4th Edn., Cambridge Univeristy.

Registrar
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore

Dr. UTTAM SHARMA
Professor & Head
Department of Physics
Shri Vaishnav Institute of Science

Chairperson
Board of Studies
Shri Vaishnav Vidyapeeth Vishwavidyalaya
Indore