Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

P.G. PROGRAM M. Sc. PHYSICS

SEM-II

Paper-I: QUANTUM PHYSICS-2

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				
MSPH 201	DC	QUANTUM PHYSICS-2	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 Vidyapeeth Vishwavidyalaya, Indore

MSPH201[QUANTUM MECHANICS-2]

Unit-I: Perturbation Theory: Introduction, Stationary or time Independent perturbation theory, Perturbation theory for Non-degenerate case, Evaluation of First order energy, Evaluation of first order wave function, Evaluation of Second order energy and wave function, Perturbed Harmonic Oscillator, Stark Effect.

Unit-II: Time-dependent perturbation theory, Transition probability, Emission and Absorption of Radiation, Einstein A and B coefficients and transition probabilities, adiabatic approximation and Sudden approximation.

Unit-III: Variation Method: Introduction and its principle. Derivation of Secular equation, Application of Variation method: Energy in the ground state of Hydrogen atom, Vander Waal's Interaction, Ground state of Helium.

Unit-IV: The W.K.B. Approximation,Principle of W.K.B. Approximation method, Application of W.K.B. Approximation Method: a. Transmission through a barrier, transmission coefficient b. Theory of α-Decay, Geiger-Nuttel Law.

Unit-V: Identical particles: Introduction, Physical Concept of Identity, Symmetric and anti-symmetric wave functions, Exchange symmetry of wave function, Distinguishability of Identical Particles, Pauli Spin Matrices.

References

1. L I Schiff: *Quantum Mechanics*, Publisher: McGraw-Hill.
2. S Gasiorowicz: Quantum Physics, Publisher: John Wiley & Sons; 3rd Edition edition.
3. B.Craseman and J D Powell: *Quantum Mechanics*, Publisher: Addison Wesley Longman *Publishing* Co.
4. A P Messiah: *Quantum Mechanics*, Vol. II North Holland Publishing Company.
5. J J Sakurai: Modern Quantum Mechanics, Publisher: Pearson Addison-Wesley; 2 edition.
6. Mathews and Venkatesan: *Quantum Mechanics*, Publisher, Tata McGraw-Hill Education.

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

P.G. PROGRAM M. Sc. PHYSICS

SEM-II

Paper-II: SOLID STATE 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				
MSPH202	DC	SOLID STATE PHYSICS	60	20	20	0	0	3	1	0	4

Course Objectives:-

1 To develop the comprehensive understanding of laws of physics related to Solid state 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 Solid state 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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Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

MSPH202[SOLID STATE PHYSICS]

Unit – 1: Solids: Amorphous and Crystalline Materials, Lattice with a Basis, Unit Cell, Primitive unit cell, Symmetry elements in Crystals, Examples of Crystal structures, Lattice constants, Miller Indices and their important features for crystal planes and crystal directions, Bravais lattice, Reciprocal lattice.

Unit – II: X-ray diffraction: Bragg formulation, Van Laue formulation of X-ray diffraction, Laue method, Debye-Scherrer method. Free electron theory and electronic specific heat, Relaxation time, Collision frequency and Mean free path,Density of Energy states and Fermi distribution function.

Unit – III: Electron motion in a periodic potential, band theory of solids:Kronig Penny model. Brillouin Zone. Conductors, Semiconductors and insulators, Mobility and electrical conductivity,Hall Effect, Scattering of Phonons, Impurity scattering and thermoelectric effects

Unit – IV: Lattice Vibrations and Phonons: Linear Mono-atomic and Di-atomic Chains. Acoustical and Optical Phonons, Qualitative Description of the Phonon Spectrum in Solids,Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids, T^3law

Unit – V: Periodic potential and Bloch's theorem, Proof of Bloch theorem, Superconductivity: type-I and type-II superconductors,Josephson junctions,Ginzsburg - Landau theory and application to Josephson Effect: d-c Josephson effect, a-c Josephson effect,

References:

1. Solid State Physics: N. W. Ashcroft and N. D. Mermin. *Publisher*: New York : Holt, Rinehart and Winston.
2. Solid State Physics: C. Kittel. *Publisher*: Wiley; 8 edition
3. Intermediate Solid State Physics: A. E. Animalu. The Benjamin-Cummings *Publishing* Co.
4. Principle of Condensed matter Physics: Chaikin and Lubensky. *Publisher*: Cambridge University Press.
5. Solid State Physics, J. D. Patterson, and B. C. Bailey, Springer Berlin Heidelberg New.

ST

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

P.G. PROGRAM M. Sc. PHYSICS

SEM-II

Paper-III: NUCLEAR AND PARTICLE 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				
MSPH203	DC	NUCLEAR AND PARTICLE PHYSICS	60	20	20	0	0	3	1	0	4

Course Objectives:-

1 To develop the comprehensive understanding of laws of physics related to Nuclear 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 Nuclear Physics.

3 Student will be able to determine physical parameter experimentally with optimal usage of resources and complete the assignments in time.

MSPH203 [NUCLEAR AND PARTICLE PHYSICS]

Unit – 1: Basic nuclear properties: size, shape, charge distribution, spin and parity. Binding energy, liquid drop model, semi empirical mass formula, Shell model, Fission and fusion, Magic numbers.Spin and angular momenta of nuclear ground state.

Unit –II: Nature of the nuclear force, Meson theory of nuclear forces, exchange and tensor forces, charge-independence and charge-symmetry, Spin dependence of nuclear forces. Quadruple moment.

Unit –III: Deuteron problem, Evidence of shell structure, single-particle shell model, its validity and limitations, Rotational spectra.

Unit – IV: Elementary ideas of alpha, beta and gamma decays, Fermi theory of Beta-decay, Electric and magnetic multipole radiation, Selection rules, Kinds of nuclear reactions, nuclear reaction kinematics; Compound and direct reactions, Reciprocity theorm.

Unit V: Classification of elementary particles, Fundamental interactions: electromagnetic, strong, weak and gravitational interactions.Symmetries and conservation laws; SU(2), SU(3) symmetry. Parity and charge conjugation.

References:

1. Introductory Nuclear Physics- Y. R. Wagmare ,*Publisher*: Oxford & IBH Oub.
2. Nuclear Physics- R. R. Roy and B. P. Nigam ,*Publisher*: NEW AGE INTERNATIONAL *PUBLISHERS* LTD.
3. Nuclear Physics- Rajkumar.,*Publisher*: Campus Books International.
4. Elementary Nuclear Physics- D. C. Tayal , Himalaya *Publishing* House, Mumbai.
5. Introduction to nuclear physics: H.A. Enge , Addison-wesley.
6. Concepts of nuclear physics: B. Cohen ,*Publisher*: McGraw-Hill Inc.,US.

Shri Vaishnav Vidhyapeeth Vishvavidhyalaya, Indore

P.G. PROGRAM M. Sc. PHYSICS

SEM-II

Paper-IV: ELECTRODYNAMICS

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				
MSPH 204	DC	ELECTRODYNAMICS	60	20	20	0	0	3	1	0	4

Course Objectives:-

1. To develop the comprehensive understanding of laws of physics related to Electrodynamics 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 Electrodynamics.
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

MSPH204 [ELECTRODYNAMICS]

Unit-I: Review of four-vector and Lorentz transformation in four-dimensional space; Electromagnetic field tensor in four dimensions and Maxwell's equations, Wave equation for vector and scalar potential and solution.

Unit-II: Retarded potential and Leinard- Wiechert Potential; Electric and magnetic fields due to a uniformly moving charge, Reaction force of radiation; Abraham-Lorentz equation of motion.

Unit-III: Motion of charged particles in electromagnetic field: Uniform E and B fields, Diffusion across magnetic fields, Time varying E and B fields. Elementary concept: Plasma oscillations, Debye shielding, Plasma parameters.

Unit-IV: Hydro dynamical description of plasma: Fundamental equations, Hydro magnetic waves: Magneto sonic and Alfven waves, wave phenomena in magneto plasma.

Unit-V: Polarization, Phage velocity, Group velocity, Cut-offs, Resonance for electromagnetic waves propagating parallel and perpendicular to the magnetic field, Propagation through ionosphere and magnetosphere.

References:

1. Panofsky and Philips: Classical electricity and magnetism, *Publisher*: Dover Publications 2 edition.
2. Jackson: Classical electrodynamics, *Publisher*: John Wiley & Sons; 3rd Edition edition.
3. Introduction to Electrodynamics: D.J. Griffith *Publisher*: Prentice Hall; 3rd edition.
4. Classical Theory of Fields: L.D. Landau and E.M. Lifshitz *Publisher*: Butterworth-Heinemann Ltd; 4th Revised.
5. *Schaum's Outline* Series. McGRAW-HILL.

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

P.G. PROGRAM M. Sc. PHYSICS

SEM –II

Paper-V: PHYSICS PRATICAL-II

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				
MSPL205	DC	Physics Practical-II	00	00	00	90	60	0	0	12	6

List of Experiments(Any Eight)

1. Determination of wavelength by constant deviation prism.
2. Verification of Fresnel's formulas.
3. Determination of Young's modulus and Poisson's ratio of glass by Cornu's method.
4. Estimation of band energy gap of a semiconductor.
5. Hall effect and determination of type and number of carriers.
6. Determination of the value of e/m (specific charge ratio) by Bush method.
7. Verification of Cauchy's formula.
8. Determination of the B-H Curve.
9. Temperature variation of resistivity of semiconductor by four probe method and calculationof the band gap.
10. Determination of Stefan constant.
11. Determination of velocity of ultrasonic waves.
12. Study of Faraday Effect using He-Ne Laser.
13. Determination of Ionization Potential of Lithium.
14. Study of Zeeman Effect.
15. Determination of Dissociation Energy of Iodine.

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