Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

Semester - II

Subject code	Subject Name	Teaching & Evaluation Scheme								
		Theory			Practical		Th	T	P	Credit
		End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
MSPH201	**Quantum mechanics – II**	60	20	20	0	0	3	1	0	**4**

Course Objectives	1. To develop the comprehensive understanding of laws of physics related to Quantum Mechanics - II 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 Mechanics - II. 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).**
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QUANTUM MECHANICS – II

UNIT I: Linear Harmonic oscillator II: Introduction, solutin of eigen value problem, uncertainty product, harmonic oscillator wave functions, coherent state, time evolution of coherent state, number operator, unitary transformation, The Schrodinger picture, The Heisenberg picture.

UNIT II: Variational Method: Basic principles with two examples; i. the hydrogen atom, trial wave function, normalized wave function ii. Helium Atom, trial wave function, minimum energy, Application to excited states, linear variational functions with example; H2+ ions: Hamiltonian trial function, secular equation.

UNIT III: Helium Atom: The independent particle approximation; hamiltonian eigen values, Electron interaction energy; variational method, Exchange degenracy and identical particles, the pauli exclusion principle; ground state wave functions and general wave function, excited states of helium, fine structure.

UNIT IV: Elementary theory of Scattering: the classical defination of scattering cross section, physical interpretation of the cross section, quantum theory of scattering; green's function, Born approximation, application of born approximation for shielded Coulomb potential. Method of partial waves: scattering by hard sphere, scattering of neutrons by photons, Coulomb scattering, considerations for identical particles.

UNIT V: Semiclassical theory of radiation and Einstein coefficients: Introduction, The einstein coefficients, Atom field interaction: interaction energy, dipole matrix element, probability for stimulated emission, transisition probability, spontaneous emission rate, the selection rule.

Books recommended:

1. Quantum Mechanics: J. J. Sakurai.
2. Quantum Mechanics: L I Schiff.
3. Quantum Mechanics: B. H. Bransden and C.J. Joachain.

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		Theory			Practical		Th	T	P	Credit
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MSPH202	**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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SOLID STATE PHYSICS

UNIT I: Crystal structure and binding: Crystalline state, Symmetry operations, point groups and crystal system, fundamental types of lattices, structure of NaCl, CsCl, Diamond and ZnS,

UNIT II: Diffraction of x-rays by crystals, the Laue, Powder and Rotating crystal methods, Bragg's law, Properties of reciprocal lattice, Brillouin zone, Ionic, Covalent, Molecular and Hydrogen bonded crystals, Lattice energy of ionic crystals.

UNIT III: Crystal vibrations: Vibrations of monoatomic and diatomic linear lattices, acoustical and optical phonons, dispersion relation for three dimension crystals, inelastic neutron scattering, elastic properties of solids, specific heat of solids, Einstein and Debye theory of specific heat, anharmonic crystal interactions, thermal expansion, Raman effect, Mössbauer effect.

UNIT IV: Defects: Point defects, line defects and planer (stacking) faults, the role of dislocations in plastic deformation and crystal growth, the observation of imperfections in crystals, X ray and electron microscopic techniques.

UNIT V: Magnetism: Quantum theories of diamagnetism and paramagnetism, Paramagnetic susceptibility of conduction electrons, Weiss molecular fields theory of ferromagnetism, Exchange interaction, Origin of magnetic domain and domain walls, Collective magnetic excitations, Spin waves, dispersion of spin waves.

Books Recommended:

1. Solid State Physics, J. J. Quinn, K. S. Yi, Springer-Verlag Berlin Heidelberg 2009
2. Intermediate Quantum theory of Crystalline Solids, A. O. E. Animalu, Prentice Hall of India private Limited, New Delhi 1977.
3. Crystallography for Solid State Physics, A. R. Verma, and O. N. Srivastava, New Age International (P) Ltd. 2001.
4. Introduction to Solid State Physics, C. Kittel, John Wiley and Sons, New York, 2005.
5. Solid State Physics, N. W. Ashcroft, and N. D. Mermin, Harcourt Asia (P) Ltd. 2001.

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		Theory			Practical		Th	T	P	Credit
		End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
MSPH203	**Statistical Mechanics**	60	20	20	0	0	3	1	0	**4**

Course Objectives	1. To develop the comprehensive understanding of laws of physics related to Statistical 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 Statistical 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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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).**
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STATISTICAL MECHANICS

UNIT I: Elements of Thermodynamics: Laws of thermodynamics and their consequences, Thermodynamical potentials, Maxwell relations, chemical potential. Fundamental of Statistical Mechanics: Phase space. Statistical ensembles. Fluctuations. Density of distribution in phase space. Postulate of equal a priori probabilities. Most probable distribution. Liouville's theorem. Density matrix.

UNIT II: Equilibrium ensemble: Micro Canonical, Canonical and Grand Canonical ensemble. Partition function, Thermodynamic function. Mean energy, pressure and free energy. Entropy in terms of probability. Gibb's paradox. Sakur-tetrode expression Equivalence of three equilibrium ensemble. Fluctuations in energy and particle number in Canonical and Grand Canonical ensemble.

UNIT III: Maxwell distribution: Maxwell distribution function. Maxwell distribution of velocities. Doppler broadening of spectral lines. Classical Statistical Mechanics: Evaluation of partition function for ideal gas.

UNIT IV: Quantum Statistical Mechanics: Indistinguishability and Quantum statistics. Symmetric and antisymmetric wave function. Quantum distribution function: Ensembles in Quantum Statistical mechanics. Bose Einstein and Fermi Dirac statistics. Boltazman limit of Bose and Fermi gases. Bose Einstein condensation. Weakly and strongly degenerate Fermi gas.

UNIT V: Phase transition: First and Second order phase transition, Clausius-Clapeyron equation, critical indices, Order parameter, Landau theory of phase transition, Cooperative phenomena, Ising model, Bragg-Williams approximation, One dimensional Ising model, Mean field theory.

REFERENCES

1. Statistical Physics : Berkeley Physics Course Volume 5 by F Reif (Tata McGraw-Hill Company Ltd).
2. Statistical and Thermal Physics: an introduction by S.Lokanathan and R.S.Gambhir. (P.H.I.).

3. Statistical Mechanics by R. K. Patharia.(Oxford: Butterworth).
4. Statistical Mechanics by K. Huang (Wiley)
5. Statistical Mechanics by eyringeyringeyring
6. Unified Physics by R. P. Goyal.
7. Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears and
8. G.L. Salinger, Narosa University Physics, Ronald Lane Reese, Thomson Brooks/Cole.

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Semester – II

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		Theory			Practical		Th	T	P	Credit
		End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
MSPH204	**Electrodynamics**	60	20	20	0	0	3	1	0	**4**

Course Objectives	3. 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. 4. To work ethically as member as well as leader in a diverse team.
Course Outcomes	3. Student will be able to understand and solve the problems related to Electrodynamics. 4. Student will be able to determine physical parameter experimentally with optimal usage of resources and complete the assignments in time.

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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).**
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ELECTRODYNAMICS

UNIT I: Boundary value problems in Electrostatics: Elements of Vector analysis, methods of images, field due to a point charge outside a plane-conducting medium, field due to a point charge near a spherical conductor.

UNIT II: Laplace's equation, separation of variables, Cartesian coordinates, spherical coordinates. Boundary value problems with linear dielectrics.

UNIT III: Boundary value problems in Magnetostatics: Biot and Savart Law, differential equations of magnetostatics and Ampere's law, vector potential and magnetic induction for a circular current loop.

UNIT IV: magnetic fields of a localized current distribution, magnetic moment, macroscopic equations, and methods of solving boundary value problems in magnetostatics.

UNIT V: Electromagnetic waves: E. M. waves in vacuum, linear and circular polarization, Poynting vector, refraction and reflection of EM waves at interface between two dielectrics, normal and oblique incidence, Brewster angle, total reflection, numerical problems.

Books recommended:

1. Elements of Electromagnetics: M. N. O. Sadiku.
2. Introduction to Electrodynamics: D.J. Griffith (Prentice Hall of India, N. Delhi, 2000).
3. Classical Electrodynamics: J. D. Jackson.
4. Classical Theory of Fields: L.D. Landau and E.M. Lifshitz (Pergamon Press).
5. Schaum's Outline Series: Theory and problems of Electromagnetics, J. A. Ediminister
6. Berkeley Physics Course: Electricity and Magnetism, E. M. Purcell.

Semester - II

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		Theory			Practical		Th	T	P	Credit
		End Semester University Exam	Two Term Exam	Teachers Assessment	End Semester University Exam	Teachers Assessment				
MSPL205	**Physics Practical - II**	00	00	00	90	60	0	0	12	6

Course Objectives	1. To develop the comprehensive understanding of laws of 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 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).**
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List of Experiments:

1. Determination of wavelength by constant deviation prism.
2. Estimation of band energy gap of a semiconductor.
3. Hall effect and determination of type and number of carriers.
4. Determination of the value of e/m (specific charge ratio) by Bush method.
5. Verification of Cauchy's formula.
6. Determination of the B-H Curve.
7. Temperature variation of resistivity of semiconductor by four probe method and calculation of the band gap.
8. Determination of Stefan constant.
9. Determination of Planck's constant by using photocell.
10. To plot the probability distribution curve.

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		Theory			Practical		Th	T	P	Cred-it
		End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
MSPR206	**Presentation**	00	00	00	00	60	0	0	0	02

Note: Power point presentaion based on any topic of the theory papers of current sem syllabus.

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		Theory			Practical		Th	T	P	Cred-it
		End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem University Exam	Teachers Assessment				
MSCV207	**Comprehensive Viva**	00	00	00	00	90	0	0	0	04

Note: Comprehensive Viva of the candidates in presence of subject expert and faculty members.