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).**
P	Practical	

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

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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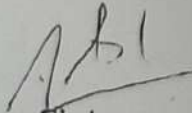## Shri Vaishnav Institute of Science

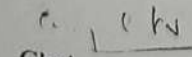### Department of Physics

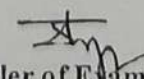### Choice Based Credit System (CBCS)

M.Sc. Physics II Sem

Subject Code	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	Credit
MSPH202	Digital Electronics	60	20	20	0	0	4	0	0	4

Course Objectives	1. To develop the comprehensive understanding of laws of physics related to Digital 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 Digital Electronics. 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	

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

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Department of Physics

Choice Based Credit System (CBCS)

M.Sc. Physics II Sem

MSPH202: DIGITAL ELECTRONICS

UNIT I: MOSFET, MESFET, HEMT and HBT: Structure, working, derivations of equations for I-V characteristics under different conditions, High frequency limits. Scaling of MOS devices and short channel FET.
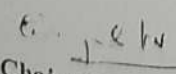
UNIT II: Introduction to Logic families: TTL circuits: 7400 devices, TTL characteristics, TTL overview, Encoders and Decoders, DTL, RTL, MOS, CMOS, Classification of IC circuits: SSI, MSI. LSI, VLSI, ULSI.
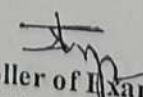
UNIT III: Registers and counters: Buffer registers, Shift register, Ripple counters, Synchronous counters, Ring counters, other counters and Bus-organized computer. Flip-Flops: RS-latches, Level clocking, D-latches and flip-flops, JK master slave flip-flops.

UNIT IV: Oscillators: The phase shift oscillator, Wein bridge oscillator, LC-tunable oscillators, Multivibrator, Monostable and Astable. Simple-as-possible computer (SAP-1): Architecture, Instruction set, Programming, Fetch cycle, Execution cycle, Schematic diagram, Micro Programming.

UNIT V: Simple-as-possible computer-II (SAP-2): Bidirectional resistors, Architectures, Memory reference instructions, Registers instruction, Jump and call instructions, Logic instructions. Simple-as-possible computers (SAP-3): Programming model, Arithmetic instructions, Increments, decrements and multiples Logic instructions.

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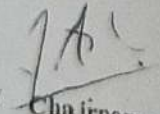
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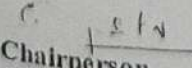
M.Sc. Physics II Sem

MSPH202: DIGITAL ELECTRONICS
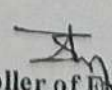
Reference

1. S M Sze: Semiconductor devices, (John Wiley & Sons)
2. M S Tyagi: Introduction to semiconductor materials and devices, (John Wiley & Sons)
3. M Sayer and A Mansingh: Measurement, instrumentation and experimental design in physics and engineering, (Prentice Hall of India, New Delhi)
4. Ajoy Ghatak and K Thyagarajan: Optical electronics, (Cambridge University Press)
5. J Millmann and C C Halkias: Integrated electronic: Analog and digital circuits and systems, (Tata Mcgraw-Hill Education, New Delhi)
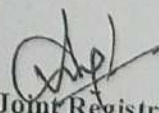6. G K Mithal: Electronic devices and circuits, (Khanna Publishers)

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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				
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.

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	

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

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.

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				
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.

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	

Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

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

Subject code	Subject Name	Teaching & Evaluation Scheme								
		Theory			Practical		Th	T	P	Cred-it
		End Sem University Exam	Two Term Exam	Teachers Assessment	End Sem 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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P	Practical	

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.