Shri Vaishnav Vidhyapeeth Vishvavidhyalaya, Indore

P.G. PROGRAM M. Sc. PHYSICS

SEM-IV

Paper-I: SEMICONDUCTOR FABRICATION AND TECHNOLOGY

SUB-JECT CODE	Catego-ry	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRAC-TICAL		Th	T	P	CREDITS
			End Sem Universi ty Exam	Two Term Exam	Teac hers Ass ess men t	End Sem Uni vers ity Exa m	Tea che rs Ass ess me nt				
MSPH 401	DC	SEMICONDUCTOR FABRICATION AND TECHNOLOGY	60	20	20	0	0	3	1	0	4

Course Objectives:-

1. To develop the comprehensive understanding of laws of physics related to Semiconductor Fabrication and Technology 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 Semiconductor Fabrication and Technology.
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

MSPH 401 [Semiconductor Fabrication and Technology]

Unit-I: Introduction: Semiconductor materials, Semiconductor devices, Semiconductor process technology. Basic Fabrication steps, Oxidation, Photolithography and Etching, Diffusion and ion-implantation, Metallization, Material Characterization; Wafer shaping, Crystal Characterization.

Unit-II: Oxidation and Etching: Thermal oxidation process; Kinetics of growth, Thin Oxide growth. Impurity Redistribution during oxidation, Masking Properties of silicon Dioxide, Oxide Quality and Oxide Thickness Characterization. Wet Chemical Etching; Silicon and Aluminum Etching Dry Etching; Plasma Fundamentals, Reactive plasma Etching Techniques and Applications

Unit-III: Diffusion: Basic Diffusion Process; Diffusion Equation, Diffusion, Profiles, Evaluation of Diffused Layers, Concentration Dependent Diffusivity, and Lateral Diffusion.

Unit-IV: Ion-implantation: Range of Implanted ions; Ion distribution, Stopping, Channeling. Implant Damage and Annealing. Implantation related Processes; Multiple Implantation and Masking, High energy current implantation.

Unit-V: IC- Manufacturing and Challenges: Electrical testing and Packaging. Computer integrated Manufacturing. Ultra shallow Junction Formulation, New Materials for interconnection, Power Limitations, System on a Chip

Text and Reference Books:

1. Fundamentals of semiconductor fabrication: Gary S. May and S. M. Sze, John Wiley and Sons INC.
2. Digital Principles and Application: A. P. Melvino & D. P. Leech (Tata McGraw-Hill Eduction (P) Ltd.
3. Electronics: D. S. Mathur (S. Chand Publishing).
4. Digital Communications: W. Tomasi (Prentice Hall).
5. Digital Computer Electronics: A. P. Malvino and Brown (Tata McGraw-Hill Eduction (P) Ltd.)

Shri Vaishnav Vidhyapeeth Vishvavidhyalaya, Indore

P.G. PROGRAM M. Sc. PHYSICS

SEM-IV

Paper-II: LASER PHYSICS-II

SUB-JECT CODE	Catego-ry	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRAC-TICAL		Th	T	P	CREDITS
			End Sem Universi ty Exam	Two Term Exam	Teac hers Ass ess men t	End Sem Uni vers ity Exa m	Tea che rs Ass ess me nt				
MSPH 402	DC	LASER PHYSICS-II	60	20	20	0	0	3	1	0	- 4

Course Objectives:-

1. To develop the comprehensive understanding of LASER 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 LASER Physics.
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

MSPH 402 [LASER PHYSICS-II]

Unit I: Multimode and pulse lasing Introduction, Q-Switching, Methods of Q Switching: Mechanical Q-Switching , Electro-Optic Q-Switching, Multimode Laser Oscillation, Phase-Locked Oscillators, Mode Locking, Amplitude-Modulated Mode Locking, Frequency-Modulated Mode Locking, Methods of Mode Locking.

Unit II: Optical Fibre Communication: Introduction, Ray Theory of Light Propagation through Optical Fibre, Acceptance Angle, Numerical Aperture, Types of Optical Fibre: SMF and MMF, Pulse Dispersion: Its Types and Impact on Information capacity, Graded Index Optical Fibre, Attenuation and Losses in Optical Fibre, Applications of Optical Fibre.

Unit III: Laser Material processing: Cutting, Welding, Drilling, Transformation Hardening, Melting and Rapid Solidification, Surface Alloying, Laser Cladding, Laser Glazing.

Unit IV: Atomic Energy: Uranium Isotope Separation (Enrichment of U_{235}), Laser induced fusion, Defense Applications: Target Designation, Range finger, Guided missile and bomb, Anti missile system.

Unit V: Laser Doppler Velocity-Metery, Laser Application in Pollution Detection and Environmental Measurements, Medical Applications of Lasers: Eye Surgeries, Endoscopic Surgeries, Laser Skin treatments.

Text and Reference Books

1. Introduction to Atomic and Molecular Spectroscopy by V. K.Jain
2. Lasers - Fundamentals and Applications, K. Thyagarajan, Springer.
3. Medical Applications of Laser. D.R. Vij and K. Mahesh, Springer.
4. Optical Electronics, M. Yariv.
5. Laser Spectroscopy, Demtroder:
6. Non-Linear Spectroscopy, Letekhov :
7. Principles of Lasers, Svelto
8. Lasers and Non-linear Optics, B.B. Laud.
9. Industrial Applications of Lasers (Second Edition), *John F. Ready,* Elsevier

Shri Vaishnav Vidhyapeeth Vishvavidhyalaya, Indore

P.G. PROGRAM M. Sc. PHYSICS

SEM-IV

Paper-III: PLASMA PHYSICS-II

SUB-JECT CODE	Catego-ry	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRAC-TICAL		Th	T	P	CREDITS
			End Sem Universi ty Exam	Two Term Exam	Teac hers Ass ess men t	End Sem Uni vers ity Exa m	Tea che rs Ass ess me nt				
MSPH 403	DC	PLASMA PHYSICS-II	60	20	20	0	0	3	1	0	4

Course Objectives:-

1. To develop the comprehensive understanding of laws of 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 Outcomes:-

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.

Shri Vaishnav Vidhyapeeth Vishvavidhyalaya, Indore

MSPH 403 [PLASMA PHYSICS-II]

Unit I: Kinetic theory of Plasma: Boltzman Equations, Equations of Kinetic Theory, Derivation of the Fluid Equations, The Meaning of Landau Damping, A Physical Derivation of Landau Damping, BGK and Van Kampen Modes, Experimental Verification.

Unit II: 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 nanofacbrication, dielectric barrier discharge (DBD), plasma etching.

Unit III: 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.

Unit IV: Plasma Processing: DC-Discharges, Types of Low Pressure Discharges, Regions in a Glow Discharge, Processes in the Cathode Region, The Hollow Cathode Effect, Thermionic Emitters, The Negative Glow, The Positive Column, PACVD techniques.

Unit V: Dusty and Quantum plasma: Laser Induced Plasma Medium, Strongly and Weakly coupled plasma, conditions for strongly coupled plasma, Quantum plasma, Dusty Plasma, Charging of dust particles, Forces on dust particles.

Text and reference books

1. J D Jackson: Classical electrodynamics (Berkley, California, 1974).
2. J A Bittencourt: Fundamentals of Plasma Physics (Springer, III Edition).
3. F F Chen: Introduction to Plasma Physics (Plenum Press, III Print).
4. Introduction of dusty plasma, P. K. Shukla.
5. Quantum Plasma, F. Haas.

Shri Vaishnav Vidhyapeeth Vishvavidhyalaya, Indore

P.G. PROGRAM M. Sc. PHYSICS

SEM - IV

Paper-IV: MATERIAL SCIENCE-II

SUB-JECT CODE	Catego-ry	SUBJECT NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRAC-TICAL		Th	T	P	CREDITS
			End Sem Universi ty Exam	Two Term Exam	Teac hers Ass ess men t	End Sem Uni vers ity Exa m	Tea che rs Ass ess me nt				
MSPH 404	DC	MATERIAL SCIENCE-II	60	20	20	0	0	3	1	0	4

Course Objectives:-

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

MSPH 404 [MATERIAL SCIENCE-II]

UNIT-I: Mechanical properties of materials, Stress and strain behavior, Elastic properties of materials, Plastic deformation, tensile properties, compressive and shear deformation, hardness, creep, fracture, fatigue.

UNIT-II: Magnetic materials: Magentocrystalline anisotropy, Induced magnetic anisotropy, Magnetostrction, Magentoelastic energy, Magnetoelastic coupling, Volume changes in magentostriction, Villari effect, Wiedemann effect, Inverse Wiedemann effect, Matteucci effect, ΔE effect, Barkhausen effect, Magentization process, Technical magnetization, Magnetic after effect, Soft and hard magnetic materials, Ferrites their structure and uses..

UNIT-III: Corrosion: Mechanisms of localized corrosion, Oxidation, Thermodynamics oxidation, Oxidation resistance, Acquaous corrosion, Anodic dissolution, Corrosion prevention Development of environmentally-friendly protective coating systems

UNIT-IV: Materials superconducting at liquid Helium temperatures, High- T c metal oxides, Organic materials, Fullerenes, Borocarbides and Diborides, Preparation and characterization of superconducting materials, Crystal Structure, Phase Diagrams and Application of Low and High- T c superconductors.

UNIT-V: Liquid phase synthesis Precipitating Nanoparticles: (1) colloidal methods; (2) sol – gel processing; (3) water – oil microemulsions method; (4) hydrothermal synthesis; and (3) water – oil microemulsions method; (4) hydrothermal synthesis; and (5) polyol method.

Text and Reference Books

1. Materials Science and Engineering, W. D. Callister, Jr. Wiley Eastern Limited, 1984.
2. Superconductivity Today, T. V. Ramakrishnan and C. N. R. Rao, Wiley Eastern Limited, 1992.

Shri Vaishnav Vidhyapeeth Vishvavidhyalaya, Indore

P.G. PROGRAM M. Sc. PHYSICS

SEM-IV

Paper-IV: INSTRUMENTATION, MEASUREMENT AND ANALYSIS-II

SUB-JECT CODE	Catego-ry	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				
MSPH 405	DC	INSTRUMENTATION, MEASUREMENT AND ANALYSIS-II	60	20	20	0	0	3	1	0	4

Course Objectives:-

3. To develop the comprehensive understanding of laws of physics related to Instrumentation, Measurement & Analysis 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 Instrumentation, Measurement & Analysis.
4. 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

MSPH 405 [INSTRUMENTATION, MEASUREMENT AND ANALYSIS-II]

Unit I: a. Introduction of SEM (Scanning Electron Microscopy).

b. Principle & Measurement Technique of SEM.

c. Analysis of SEM Spectra.

Unit II: a. Introduction of TEM (Transmission Electron Microscopy).

b. Principle & Measurement Technique of TEM.

c. Analysis of TEM Spectra.

Unit III: a. Introduction of EPR (Electron Paramagnetic Resonance).

b. Principle & Measurement Technique of EPR.

c. Analysis of EPR Spectra.

Unit IV: a. Introduction of EDX (Energy Dispersive X-ray Spectroscopy).

b. Principle & Measurement Technique of EDX.

c. Analysis of EDX Spectra.

Unit V: a. Introduction of RGA (Residual Gas Analyser).

b. Principle & Measurement Technique of RGA.

c. Analysis of RGA Spectra.

Text and References Books:

1. Scanning Electron Microscopy: Physics of Image Formation and Microanalysis, Ludwing Leimer.
2. Transmission Electron Microscopy: Physics of Image Formation and Microanalysis, Ludwing Leimer, II edition.

Shri Vaishnav Vidhyapeeth Vishvavidhyalaya, Indore

P.G. PROGRAM M. Sc. PHYSICS

SEM –IV

Paper-V: PHYSICS PRATICAL

SUB-JECT CODE	Catego-ry	SUBJECT NAME	TEACHING & EVALUATION SCHEME									
			THEORY			PRAC-TICAL		Vi-va/P re-sen-ta-tion	Th	T	P	CREDITS
			End Sem Univ ersity Exam	Two Term Exam	Teac hers Asse ssme nt	End Sem Univ ersit y Exam	Teac hers Ass ess men t					
MSPL 407	DC	PROJECT PHASE-II & PRESENTATION	00	00	00	00	00	200	0	0	-12	8

NOTE: The student perusing their project under the supervision of at least one of the faculty member of the institute on the topic of the syllabus.