

"Dissemination Education for Knowledge, Science and Culture"
 -Shikshanmaharshi Dr. Bapuji Salunkhe
 Shri Swami Vivekanand Shikshan Sanstha's

Vivekanand College, Kolhapur
 (Empowered Autonomous)

Department of Physics
Syllabus Completion Report (PG)

Academic Year: 2023-24

Subject: Physics

Name of the teacher: **Mr. A. N. GORE**

Month June				Module/Unit:	Syllabus Covered / Not Covered
Course	Lectures	Practicals	Total		
M.Sc. I	16	-	16	Research Methodology Meaning of research, objectives of research, motivation in research, types of research, research approaches, significance of research, research methods versus research and scientific methodology, importance of knowing how research is done, research progress, criteria of good research.	Covered
M.Sc. II	16	-	16	Thin Film Deposition and Other Techniques Introduction, reaction types, thermodynamics of CVD, gas transport and growth kinetics, CVD process and basic systems; Spray deposition Introduction, basic instrumentation, different type of spray techniques; spray pyrolysis technique, electrospray deposition technique, advantages and disadvantages of spray deposition techniques, Electrodeposition, Spin coating, SILAR technique, Chemical bath deposition.	Covered
Month July				Module/Unit:	Syllabus Covered / Not Covered
Course	Lectures	Practicals	Total	Research Methodology	



M.Sc. I	16	-	16	Meaning of research, objectives of research, motivation in research, types of research, research approaches, significance of research, research methods versus research and scientific methodology, importance of knowing how research is done, research progress, criteria of good research.	Covered
M.Sc. II	16	-	16	Thin Film Deposition and Other Techniques Introduction, reaction types, thermodynamics of CVD, gas transport and growth kinetics, CVD process and basic systems; Spray deposition Introduction, basic instrumentation, different type of spray techniques; spray pyrolysis technique, electrospray deposition technique, advantages and disadvantages of spray deposition techniques, Electrodeposition, Spin coating, SILAR technique, Chemical bath deposition.	Covered
Month August				Module/Unit:	Syllabus Covered / Not Covered
Course	Lectures	Practicals	Total		
M.Sc. I	16	-	16	Research Methodology Research design: meaning of research design, features of good design, important concepts of relating research design, different basic designs c) Method of data collection, types of data analysis; statistics in research, measure of central tendency, measure of dispersion; measure of asymmetry, measure of relationship, simple regression analysis, multiple correlation and regression, partial correlation	Covered



M.Sc. II	16	-	16	Thin Film Deposition and Other Techniques Types of solid solutions, substitutional, disordered, ordered, interstitial solid solution, intermediate phases ,Hume Rothery's rules, concept of solidification of metals-nucleation, homogeneous and heterogeneous nucleation, growth its new phase and phase change kinetics, solid solution hardening, Age hardening, dispersion hardening, phase transformation hardening principles of hot and cold working of metals and their effects on mechanical properties	Covered
Month September				Module/Unit:	Syllabus Covered / Not Covered
Course	Lectures	Practicals	Total	Research Methodology	
M.Sc. I	16	-	16	Vacuum deposition apparatus: Vacuum systems ,substrate materials, Thermal Evaporation methods: Resistive heating, laser evaporation, electron bombardment heating, Sputtering: sputtering variants, glow discharge sputtering, RF Sputtering, Ion beam sputtering Research Methodology Vacuum deposition apparatus: Vacuum systems ,substrate materials, Thermal Evaporation methods: Resistive heating, laser evaporation, electron bombardment heating, Sputtering: sputtering variants, glow discharge sputtering, RF Sputtering, Ion beam sputtering	Covered
M.Sc. II	-	32	32	Raman and ESR Techniques Raman Scattering-introduction theory , Rotational and Vibrational spectra, Raman spectrometer Fourier transform Raman spectrometer, Structure determination using IR and Raman - Electron Spin Resonance(ESR)-Principle, construction and working ,Total Hamiltonian, Hyperfine structure, ESR of Transition metals	Covered



Month October				Module/Unit:	Syllabus Covered / Not Covered
Course	Lectures	Practicals	Total	Unit 4: Properties and characterization of thin films	Covered
M.Sc. I	16	-	16	Mechanical properties of thin films: Introduction to elasticity, plasticity, and mechanical behavior, Electrical and magnetic properties of thin films, Optical properties of thin films, Structural characterization: X-ray diffraction, Scanning electron microscopy, Transmission electron spectroscopy, chemical characterization: X-ray Energy Dispersive Analysis (EDX), X-ray photoelectron spectroscopy (XPS)	
M.Sc. II	16	-	16	Unit I Vacuum Techniques Production of low pressures: rotary, diffusion, and sputter ion pumps; measurement of low pressure: McLeod, Pirani, thermocouple & Penning gauges; leak detection : simple methods of LD, palladium barrier and halogen leak detectors	Covered
Month December				Module/Unit:	Syllabus Covered / Not Covered
Course	Lectures	Practicals	Total	Unit 1 : Origin and general formalism	Covered
M.Sc. I	16	-	16	Sequential Stern-Gerlach experiment, analogy with polarization of light, linear vector space, linear operator, eigenfunction and eigen values, Hermitian operator, Postulates of quantum mechanics , Diracs bra and ket notation, equation of motion, schrodinger representation, Heisenberg representation, momentum representation.	
M.Sc. II	16	-	16	Unit I Vacuum Techniques Production of low pressures: rotary, diffusion, and sputter ion pumps; measurement of low pressure: McLeod, Pirani, thermocouple & Penning gauges; leak detection : simple methods of LD, palladium barrier and halogen leak detectors	Covered




Month January				Module/Unit:	Syllabus Covered / Not Covered
Course	Lectures	Practicals	Total		
M.Sc. I	16	-	16	Unit-2: Angular Momentum Angular momentum operator, angular momentum commutation relations, Eigen values of J^2 & J_z , angular momentum matrices spin angular momentum, addition of angular momenta, computation of Clebsch-Gordan coefficients in simple cases ($J_1=1/2, J_2=1/2$)	Covered
M.Sc. II	16	-	16	Unit II Low Temperature and Microscopy Techniques Production of low temperatures: Adiabatic cooling, the Joule-Kelvin expansion, adiabatic demagnetization, ^3He cryostat, principle Pomeranchuk cooling, principle of nuclear demagnetization; measurement of low temperatures. Optical microscopy, scanning electron microscopy, electron microprobe analysis, low energy electron diffraction	Covered
Month February				Module/Unit:	Syllabus Covered / Not Covered
Course	Lectures	Practicals	Total		
M.Sc. I	16	-	16	Unit 3 : Time Dependent Perturbation Theory Time dependent potentials, Time dependent Perturbation theory, Applications to interactions with the classical radiation field, energy shift and decay width, Adiabatic Approximation.	Covered



M.Sc. II	16	-	16	Unit III Atomic Absorption Spectrometry Fundamentals :principle, basic equipmentmodulation;apparatus: double beam instrument, radiation sources, aspiration and atomization; interferences, control of AAS parameters, reciprocal sensitivity and detection limit techniques of measurement : routine procedure, matrix matching method, and method of additions	Covered
Month March				Module/Unit:	Syllabus Covered / Not Covered
Course	Lectures	Practicals	Total	Unit 4 : Scattering Theory	
M.Sc. I	16	-	16	The Lippmann-Schwinger equation, The Born approximation, Optical Theorem, Eikonal approximation, Free particle states, Partial wave formalism, Low energy scattering and bound states, Resonances, Scattering of identical particles, Symmetries in scattering, Time-dependent formulation of scattering, Inelastic electron-atom scattering, Coulomb scattering.	Covered
M.Sc. II	16	-	16	Unit IV X-Ray Fluorescence Spectrometry and Mössbauer Spectroscopy The Lippmann-Schwinger equation, The Born approximation, Optical Theorem, Eikonal approximation, Free particle states, Partial wave formalism, Low energy scattering and bound states, Resonances, Scattering of identical particles, Symmetries in scattering, Time-dependent formulation of scattering, Inelastic electron-atom scattering, Coulomb scattering	Covered
Month April				Module/Unit:	Syllabus Covered / Not Covered
Lectures		Practicals	Total	Examination	-


Teacher Incharge




Dr. S. S. Latthe

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Department of Physics
Syllabus Completion Report (PG)

Academic Year: 2023-24

Subject: Physics

Name of the teacher: **Mr. A. V. Shinde**

Month June				Module/Unit:	Syllabus Covered / Not Covered
Course	Lect ures	Practicals	Total		
M.Sc. I	16	-	16	Matrices Matrix multiplication – Inner product, direct product, Diagonal matrices, trace, matrix Inversion, Gauss-Jordon Inversion, Eigenvalues and Eigenvectors, Properties of Eigenvalues and Eigenvectors, Cayley-Hamilton Theorem and applications, similar matrices and diagonalizable Matrices, functions of matrices, Quadratics forms.	Covered
M.Sc. II	-	32	32	Practicals [1] Thin film deposition by SILAR method [2] Thin film deposition by electro-deposition method [3] Thin film deposition by hydrothermal method [4] Thin film deposition by reflux method	Covered



Month July				Module/Unit:	Syllabus Covered / Not Covered
Course	Lect ures	Practicals	Total		
M.Sc. I	16	-	16	Complex Variables Limits and continuity of complex functions, Derivatives and analytic functions, Cauchy- Riemann conditions, Line integrals in the complex plane, Cauchy Integral theorem and Cauchy integral formulas, Singularities- Poles, Branch Points, Calculus of Residues- Residues Theorem, Cauchy Principle value, Pole Expansion of Meromorphic Functions, Product expansion of entire functions.	Covered
M.Sc. II	-	32	32	Practicals [1] Thin film deposition by SILAR method [2] Thin film deposition by electro-deposition method [3] Thin film deposition by hydrothermal method [4] Thin film deposition by reflux method	Covered
Month August				Module/Unit:	Syllabus Covered / Not Covered
Course	Lect ures	Practicals	Total	Fourier series and integrals	Covered



M.Sc. I	16	-	16	Fourier series and Fourier transform, Dirichlet condition, (Statement only) Properties of Fourier series: 1) convergence, 2) Integration 3) Differentiation. Physical applications of Fourier series 4) square wave (high frequencies) 5) full wave rectifier, Differentiation and integration of Fourier series, Fourier transform, Inverse functions.	
M.Sc. II	-	32	32	Practicals : [1] Thin film deposition by dip-coating method [2] Thin film deposition by CBD method [3] Microwave assisted synthesis of thin film [4] Thin film deposition by spray pyrolysis method	Covered
Month September				Module/Unit:	Syllabus Covered / Not Covered
Course	Lect ures	Practicals	Total	Special Functions	
M.Sc. I	16	-	16	Frobenius power series method, Legendre differential equation (Rodrigues' formula for Legendre polynomials, generating function, Orthogonality of Legendre polynomials), Hermite differential equation (Rodrigues' formula for Hermite polynomials, generating function, Orthogonality of Hermite polynomials), Laguerre differential equation ((Rodrigues' formula for Laguerre polynomials, generating function, Orthogonality of Laguerre polynomials)	Covered



M.Sc. II	-	32	32	Practicals : [1] Thin film deposition by dip-coating method [2] Thin film deposition by CBD method [3] Microwave assisted synthesis of thin film [4] Thin film deposition by spray pyrolysis method	Covered
Month October				Module/Unit:	Syllabus Covered / Not Covered
	Lect ures	Practicals	Total	Examination	-
Month December				Module/Unit:	Syllabus Covered / Not Covered
	Lect ures	Practicals	Total		
M.Sc. I	16	-	16	Crystallography Bonding in Solids-Ionic, Covalent and Metallic. Crystalline state of solids, Bravais's lattices and crystal structure , Symmetry elements(cubic),coordination number and packing fraction. Crystal structures CsCl, ZnS, and diamond, Brag's law in reciprocal lattice, Brillouin zones, Comparison between X-Ray, Electron and Neutron diffraction, Field ion microscopy-Principal, working and applications	Covered



M.Sc. II	-	32	32	Practicals : [1] Rietveld method of structure refinement [2] Calculation of XRD peak positions and intensities [3] Thickness measurement of thin film [4] Electrical resistivity of thin film by 2 probe method	Covered
Month January				Module/Unit:	Syllabus Covered / Not Covered
Course	Lect ures	Practicals	Total	Crystal defects: Point defects-Vacancies, Interstitials, impurities, electronic, Expression for Schottky and Frenkel defects Line defects-Edge and screw dislocation, Interpretation of SGP (Plastic deformation) Burgur's vector and circuit, Frank-Read mechanism. Planer defects, Surface defects- Grain boundaries, Tilt boundaries, Twin boundaries, Effect of Imperfections	Covered
M.Sc. I	16	-	16		
M.Sc. II	-	32	32	Practicals : [1] Rietveld method of structure refinement [2] Calculation of XRD peak positions and intensities [3] Thickness measurement of thin film [4] Electrical resistivity of thin film by 2 probe method	Covered
Month February				Module/Unit:	Syllabus Covered / Not Covered



Course	Lect ures	Practicals	Total	Dielectric, Magnetism & Superconductivity:	
M.Sc. I	16	-	16	Dielectric-Polarisation mechanism, Dielectric constant, Clausis-Mossoti relation, Magnetism Comparison between dia, Para, and ferromagnetism ,Exchange interaction. Magnetic order (Fero, Antifero and ferri), Weiss theory of magnetism Superconductivity- High Tc superconductors, BCS theory of superconductors, SQUID	Covered
M.Sc. II	-	32	32	Practicals : [1] Thermoelectric power of thin film [2] Contact angle measurement of thin film [3] Determination of band gap energy of thin film [4] Measurement of dielectric constant	Covered
Month March				Module/Unit:	Syllabus Covered / Not Covered
Course	Lect ures	Practicals	Total		
M.Sc. I	16	-	16	Semiconductor theory and devices: Energy band gap, Determination of Band gap energy, intrinsic and extrinsic semiconductors, carrier concentration, fermi level and conductivity for intrinsic and extrinsic semiconductor. Review of UJT, switching characteristics of UJT, SCR- construction and working, switching characteristics.	Covered



M.Sc. II	-	32	32	Practicals : [1] Thermoelectric power of thin film [2] Contact angle measurement of thin film [3] Determination of band gap energy of thin film [4] Measurement of dielectric constant	Covered
Month April				Module/Unit:	Syllabus Covered / Not Covered
Lectures	Practicals	Total	Examination		

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Teacher Incharge



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