DR. HOMI BHABHA STATE UNIVERSITY

Program - M. Sc.

Course -Physics

Syllabus for Semesters - I, II

(Credit Based Semester and Grading System

With effect from the academic year 2021-2022)

Scheme of Choice Based Credit System for M.Sc.(Physics)

SEM	Core Courses	DE/IE/P	GE	AE	SE	Total Credits	Non-CGPA Credits
I	Mathematical Physics (MSPHCC101T) + LAB 1 (MSPHLB101P) Classical Mechanics (MSPHCC102T) + LAB 2 (MSPHLB102P) Quantum Mechanics (MSPHCC103T) + LAB 3 (MSPHLB103P)	Solid state Physics (MSPHIE101T) + LAB4 (MSPHLB104P)	GE1: **Scientific Programming Languages** (MSPHGE101T)	AE1 Digital Electronics (MSPHAE101T)		CC : 4*3=12 P: 2*3= 6 IE: 4*1 = 4 P: 2*1=2 GE1: 2*1=2 AE: 2*1=2 **Total = 28**	MOOCs, Co/Extra Curricular Activities etc.
II	Electronics (MSPHCC201T) + LAB 5((MSPHLB201P) Electrodynamics (MSPHCC202T) + LAB 6 ((MSPHLB202P) Atomic and Molecular Physics (MSPHCC203T) + LAB 7((MSPHLB203P)	Numerical Techniques (MSPHIE201T) + LAB8 (MSPHLB204P)			SE1 Renewable Energy Resources (MSPHSE201T)	CC:4*3=12 P: 2*3=6 IE: 4*1 = 4 P: 2*1=2 SE: 4*1= 4 **Total = 28**	

MSPHCC101T: MS (M.SC.) **PH** (PHYSICS) **CC** (CORE COURSE) **T** (THEORY): **MSPHIE101T** – **MS** (M.SC.) **PH** (PHYSICS) **IE1** (INTERDISCIPLINARY) **T** (THEORY) MSPHLB**101P: MS** (MASTERS) **PH** (PHYSICS) **LB** (LAB COURSE) **P**(PRACTICAL): **MSPHGE101T: MS**(MASTERS) **PH** (PHYSICS) **GE101**(GENERIC ELECTIVES) **T** (THEORY) MSPHAE**101T: MS**(MASTERS) **PH** (PHYSICS) **AE101** (ABILITY ENHANCEMENT COURSE) **T** (THEORY) **MSPHSE201T: MS** (MASTERS) **PH** (PHYSICS) **SE201** (SKILL EENHANCEMENT COURSE) **T** (THEORY)

SEM	Core Courses	DE/ID/P	GE	AE	SE	Total Credits	Non-CGPA Credits
III	Statistical Mechanics (MSPHCC301T) Condensed Matter Physics (MSPHCC302T)	**Elective Papers** **Paper I (Any one from four)** **AE-** Electronic communication **(MSPHDE301T)** **SSP-**Thin Film Physics **(MSPHDE303T)** **SSE-** Semiconductor Devices **(MSPHDE305T)** **MS-**Fundamentals of Materials Science **(MSPHDE307T)** --- --- **Paper II (Any one from four)** **AE-**Transmission line and Microwave Devices **(MSPHDE302T)** **SSP**- Semiconductor Physics **(MSPHDE304T)** **SSE**- Thin film : Properties and Techniques **(MSPHDE306T)** **MS**- Nano science and Nanotechnology **(MSPHDE308T)** --- --- **Elective LAB (Any one from four)** **(AE-**MSPHLB301P / SSP- MSPHLB302P / SSE-MSPHLB303P / MS-MSPHLB304P) **PR-1 (Project)** **AE-**MSPHPR301P /SSP- MSPHPR302P/SSE- MSPHPR303P / MS-MSPHPR304P **GE2- Applications of Scientific Programming Languages (MSPHGE301T)**		**AE2** Python Programming (MSPHAE301T)		CC : 4*2=8 DE:4*2=8 P: 4*1 = 4 Project = 4 GE2: 2*1=2 AE2: 2*1=2 **Total = 28**	MOOCs, Co/Extra Curricular Activities etc.
IV	Characterization Techniques (MSPHCC401T)	**Elective Papers** **Paper III (Any one from four)** **AE-**Microwave measurement & Optical Fibre Communication **(MSPHDE401T)** **SSP**-Physical Properties of Solids **(MSPHDE403T)**			**SEC2:** Materials for Energy	CC : 4*2=8 DE:4*2=8 P:4*=4	

	Nuclear Physics (MSPHCC402T)	**SSE**-Semiconductor Technology **(MSPHDE405T)** **MS-**Application of Materials **(MSPHDE407T)** --- --- **Paper IV (Any one from four)** **AE**-Microprocessor and Microcontroller **(MSPHDE402T)** **SSP**-Physics of Nano materials **(MSPHDE404T)** **SSE**-Physics of Semiconductor Devices **(MSPHDE406T)** **MS**-Properties of Materials **(MSPHDE408T)** --- --- **Elective LAB (Any one from four)** **(AE-**MSPHLB401P / SSP- MSPHLB402P / SSE-MSPHLB403P / MS-MSPHLB404P) **PR-2 (Project)** **AE-**MSPHPR401P /SSP- MSPHPR402P/SSE- MSPHPR403P / MS-MSPHPR404P		(MSPHSE401T)	Project = 4 SE2: 4*1=4 **Total = 28** **TOTAL COURSE CREDITS = 112**	

ELECTIVES: AE: APPLIED ELECTRONICS SSP/SP: SOLID STATE PHYSICS SSE/SE: SOLID STATE ELECTRONICS MS: MATERIALS SCIENCE
MSPHDE3T: MS** (MASTERS) **PH** (PHYSICS) **DE** (DISCIPLINE SPECIFIC ELECTIVE) **(ELECTIVES- AE-01-02/SP-03-04/SE-05-06/MS-07-08) **T**(THEORY)

	CC	DE/IE/ P	GE	PRACT/ PROJECT	AE	SE	TOTAL
SEM I	12	4	2	8	2	-	28
SEM II	12	4	-	8	-	4	28
SEM III	8	8	2	8	2	-	28
SEM II	8	8	-	8	-	4	28
TOTAL	40	24	4	32	4	8	**112**
PERCENT	35.71	21.43	3.57	28.57	3.57	7.14	100%

Notes: There are four Electives Offered by the Department of Physics Namely: Applied Electronics, Solid State Physics, Solid State Electronics and Materials Science. Courses Selected in third Semester for a Particular Electives are Prerequisites for Courses in fourth Semester for that Specialization.

The candidate shall be awarded the degree of *Master of Science in physics* **(M. Sc. in Physics)** after completing the course meeting all the evaluation criteria. The elective course titles will appear in the statement of marks. When the elective courses are chosen from particular Electives, the statement of marks shall also carry the name of the Electives as stated below. Courses selected in third semester for particular Electives are prerequisites for courses in fourth semester for those Electives.

Course Structure of the M.Sc. Programme of HBSU (From 2021-2022)

SEM	Core Courses Credits: 4	DSE/ ID Credits: 4	GE Credits:2	AEC Credits:2	SEC Credits: 4	Lab/Projects Credits*no of Lab/Projects= Total Credits	Non-CGPA	Total Credits
I	CC101 CC102 CC103	ID101	GE101	AE101	-----	2 Credits * 4 Lab = 8 Credits (50+50+50+50=200 Marks)	MOOC's and/or Co/Extra	CC: 4*3=12 ID: 4*1 =4 GE: 2*1=2 AE: 2*1=2 Lab = 8 Total = 28
II	CC201 CC202 CC203	ID201	------	-------	SE201	2 Credits * 4 Lab = 8 Credits (50+50+50+50=200 Marks)	MOOC's and/or Co/Extra	CC: 4*3=12 ID : 4*1=4 SE: 4*1=4 Lab = 8 Total = 28
III	CC301 CC302	DE301 DE302	GE301	AE301	--------	4*1 (1 Lab) + 4*1(Lab)=8 OR 4*1 (1 Lab) + 4*1(Project)=8 OR 4*1 (1 Project) + 4*1(Project)=8 (100+100 =200 Marks)	--------	CC : 4*2=8 DE: 4*2=8 GE: 2*1=2 AE: 2*1=2 Lab + Projects = 8 Total = 28
IV	CC401 CC402	DE401 DE402	---------	---------	SE401	4*1 (1 Lab) + 4*1(Lab)=8 OR 4*1 (1 Lab)+4*1(Project)=8 OR 4*1 (1 Project)+4*1(Project)=8 (100+100 =200 Marks)	-------	CC: 4*2=8 DE: 4*2=8 SE : 4*1=4 Lab. + Projects = 8 Total = 28 Course Credit = 112

DR HOMI BHABHA STATE UNIVERSITY: M.Sc. Result Sheet																
SEM	**COURSE**	**COURSE CODE**	**COURSE TITLE**	**CREDITS**	**MARKS**						**TOTAL**		**CREDIT EARNED**	**GRADE POINT**	**CG**
					INTERNAL			**EXTERNAL**							
					MAX	**MIN**	**OBT**	**MAX**	**MIN**	**OBT**	**MAX**	**OBT**	**C**	**GP**	**C*GP**
I	CORE COURSE	CC101		4	40	16		60	24		**100**				
		CC102		4	40	16		60	24		**100**				
		CC103		4	40	16		60	24		**100**				
	ID	IE101		4	40	16		60	24		**100**				
	AEC	AE101		2	20	8		30	12		**50**				
	GE	GE101		2	20	8		30	12		**50**				
	LB	LAB101		2	-	-	-	50	20		**50**				
	LB	LAB102		2	-	-	-	50	20		**50**				
	LB	LAB103		2	-	-	-	50	20		**50**				
	LB	LAB104		2	-	-	-	50	20		**50**				
				28	200			500			**700**				
SEMESTER – I:			**TOTAL CREDITS= 28**								**TOTAL MARKS = 700**		**OBTAINED= ……/700**		
II	CORE COURSE	CC201		4	40	16		60	24		**100**				
		CC202		4	40	16		60	24		**100**				
		CC203		4	40	16		60	24		**100**				
	ID	ID201		4	40	16		60	24		**100**				
	SEC	SE201		4	40	16		60	24		**100**				
	LB	LAB201		2	-	-	-	50	20		**50**				
	LB	LAB202		2	-	-	-	50	20		**50**				
	LB	LAB203		2	-	-	-	50	20		**50**				
	LB	LAB204		2	-	-	-	50	20		**50**				
				28	200			500			**700**				
SEMESTER – II:			**TOTAL CREDITS= 28**								**TOTAL MARKS = 700**		**OBTAINED= ……/700**		
III	CORE COURSE	CC301		4	40	16		60	24		**100**				
		CC302		4	40	16		60	24		**100**				
	DSE	DE301		4	40	16		60	24		**100**				
		DE302		4	40	16		60	24		**100**				
	AEC	AE301		2	20	8		30	12		**50**				
	GE	GE301		2	20	8		30	12		**50**				
	LB/PR	LAB/PR301		4	-	-	-	100	40		**100**				
	LB/PR	LAB/PR302		4	-	-	-	100	40		**100**				
				28	200			500			**700**				
SEMESTER – III:			**TOTAL CREDITS= 28**								**TOTAL MARKS = 700**		**OBTAINED= ……/700**		
IV	CORE COURSE	CC401		4	40	16		60	24		**100**				
		CC402		4	40	16		60	24		**100**				
	DSE	DE401		4	40	16		60	24		**100**				
		DE402		4	40	16		60	24		**100**				
	SEC	SE401		4	40	16		60	24		**100**				
	LB/PR	LAB/PR401		4	-	-	-	100	40		**100**				
	LB/PR	LAB/PR402		4	-	-	-	100	40		**100**				
				28	200			500			**700**				
SEMESTER – IV:			**TOTAL CREDITS= 28**								**TOTAL MARKS = 700**		**OBTAINED= ……/700**		

Semester-I

	Course Code: **MSPHCC101T**	Course Title: **Mathematical Physics**	
	Course Credit: **4**	Total Contact Hours: 60 Hours	
Sr. No.	**Course Contents (Topics &Subtopics)**		**Reqd. Hours**
1	**Unit I** **Matrices:** Matrices Eigen values Eigen Vectors, Inner Product, Orthogonality, Unitary Hermitian Matrices, Diagonalization of Matrices, Applications to Physics Problems. Introduction to Tensor Analysis, Addition Subtraction of Tensors, Summation Convention, Contraction, Direct Product, Symmetric Antisymmetric Tensors, Kronecker Delta, Tensors in Physics-Moment of Inertia Tensor.		**15 Hours**
2	**Unit II** **Complex Variables:** Complex Variables, Complex Differentiation- Derivatives, Analytic Functions, Cauchy-Riemann Equations, Harmonic Functions, Polar Form of Cauchy-Riemann Equations, Elementary Functions-Exponential Function, Trigonometric Function, Limits, Continuity, Singular Points, Cauchy's Theorem, Cauchy's Integral Theorem, Taylor's Laurrent's Series, Residues, Cauchy's Residue Theorem, Residues at Poles, Zeroes Poles of Order M, Contour Integrals, Evaluation of Improper Real Integrals, Improper Integral Involving Sines Cosines.		**15 Hours**
3	**Unit III** **Differential Equations:** General Treatment of Second Order Linear Differential Equations with Non-Constant Coefficients, Power Series Solutions, Frobenius Method (Series Integration Method), Linear Oscillator Equation, Forced Oscillator Resonance, Legendre, Hermite Laguerre Polynomials, Bessel Equations, Non-Homogeneous Equation – Green's Function		**15 Hours**
4	**Unit IV** **Transformations:** Integral Transforms-three Dimensional Fourier Transforms its Applications to PDEs (Green Function of Poisson's PDE), Convolution Theorem, Parseval's Relation, Laplace Transforms, Laplace Transform of Derivatives, Inverse Laplace Transform Convolution Theorem, Use of Laplace's Transform in Solving Differential Equations,		**15 Hours**
	Suggested Readings		
	1. Matrices Tensorsin Physics, a. W. Joshi, 4 Th Edition, New Age International. 2. Mathematical Methods inthe Physical Sciences – M. Boas, Wiley. 3. Advanced Engineering Mathematics – E. Kreyszig, Wiley. 4. Mathematical Physics: Advanced Topics, S. D. Joglekar Crc Press 2007. 5. Mathematical Methods for Physicists – Arfken & Weber – 6th Edition-Academic Press- N.Y. 6. Mathematical Physics, A. K. Saxena, Narosa Publications		

	Course Outcomes: Students will Learn Mathematical Methods Their Application in Physics. Important Concepts Such as Linear Dependence Independence of Vectors Matrices, Number of Independent Parameters of Various Special Matrices, Second Higher Order Tensors, Special Polynomials, Laplace Transform Needed in Quantum Mechanics, Electrodynamics Etc.	

	Course Code: **MSPHLB101P**	Course Title: **Lab Course -1** Minimum Number of Experiments to be Performed Reported in the Journal = **04**
	Course Credit: **2**	Total Contact Hours: 60 Hours
Sr. No.	**Course Contents (Topics &Subtopics)**	
1	Double Slit- Fraunhofer Diffraction (Missing Order Etc.)	
2	Resistivity of a Semiconductor Using Four Probe	
3	Temperature Dependence of Avalanche Zener Breakdown Diodes	
4	Susceptibility Measurement by Quincke's Method / Guoy's Balance Method	
5	Absorption Spectrum of Specific Liquids	
6	Determination of Velocity of Ultrasonic Waves in a Given Liquid Using Ultrasonic Interferometer	
7	Diffraction at Single Double Slits Using Laser Source.	
8	LVDT Characteristics.	
9	Dielectric Constant of Liquids	
10	Solution of Linear Equations Using OCTAVE/SCILAB/MATLAB	
11	Solution of First Order Second Order Differential Equation Using OCTAVE/SCILAB/MATLAB	
12	Uranium Decay Using OCTAVE/SCILAB/MATLAB	

	Course Code: **MSPHCC102T**	Course Title: **Classical Mechanics**	
	Course Credit: **4**	Total Contact Hours: 60 Hours	
Sr. No.	**Course Contents (Topics &Subtopics)**		**Reqd. Hours**
1	**Unit I**		**15 Hours**
	Lagrangian Formulation. Hamilton's Principle: Review of Newton's Laws, Mechanics of a Particle, Mechanics of a System of Particles, Frames of References, Rotating Frames, Centrifugal Coriolis Force, Constraints, D' Alembert's Principle Lagrange's Equations, Velocity-Dependent Potentials the Dissipation Function, Simple Applications of the Lagrangian Formulation. Hamilton's Principle, Calculus of Variations, Derivation of Lagrange's Equations from Hamilton's Principle, Lagrange, Extension of Hamilton's Principle to Non-Holonomic Systems, Advantages of a Variational Principle formulation		
2	**Unit II**		**15 Hours**
	Central Force Problem: two Body Problem, the Equation of Motion First Integral, Equation of Orbit, Kepler's Laws, Kepler's Problem, General Analysis of Orbits, Stability of Orbits, Artificial Satellites, Rutherford Scattering: Differential Scattering Cross – Section, Rutherford Formulae for Scattering.		
3	**Unit III**		**15 Hours**
	Variational Principle and Hamiltonian Formulation: Hamilton's Principle, Hamiltonian, Generalized Momentum, Constant of Motion, Hamilton's Canonical Equations of Motion, Deduction of Canonical Equations from Variational Principle, Applications of Hamilton's Equations of Motion. Principle of Least Action, Proof of Principle of Least Action.		
4	**Unit IV**		**15 Hours**
	Canonical Transformations and Hamilton's - Jacobi Theory: Generating Functions, Illustrations of Canonical Transformations, Condition for Transformation to be Canonical, Examples. Poisson's Brackets, Poisson's Theorem, Properties of Poisson's Brackets, Hamilton's Canonical Equations in Terms of Poisson's Brackets, Hamilton's – Jacobi Theory, Solution of Harmonic Oscillator Problem by Hj Method.		
	Suggested Readings:		
	1. Classical Mechanics, by H Goldstein (Addison Wesley 1980). 2. Classical Mechanics, by N C Rana P S Joag (Tata McGraw Hill 1991). **3.** Introduction to Classical Mechanics, by R G Takwale P S Puranik (Tata McGraw Hill 1999). **4.** Classical Mechanics, by Gupta, Kumar Sharma (Pragati Prakashan 2000).		
	Course Outcomes:		

	Students will understand the discipline-specific knowledge in classical mechanics, covering the subjects basic concepts of classical mechanics, Newton's laws applications, Lagrange's equations Hamilton's Equation their applications. Students shall be able to use Newtonian, Lagrangian Hamiltonian methods for solving mechanics problems	

	Course Code: **MSPHLB102P**	Course Title: **Lab Course -2** Minimum Number of Experiments to be Performed Reported in the Journal = **04**
	Course Credit: **2**	Total Contact Hours: 60 Hours
Sr. No.	**Course Contents (Topics &Subtopics)**	
1	Verification of State Tables of R-S Flip-Flop, J - K Flip-Flop, T Flip-Flop, D Flip-Flop Using NAND, NOR Gates.	
2	Half and Full Adder-Subtractor Circuits Using ICs.	
3	Verification of State Tables T Flip-Flop, D Flip-Flop Using NAND, NOR Gates.	
4	Shift Register Using ICSN54AS194	
5	Study of Presentable Counters - 74190, 74193	
6	Study Four Bit Binary Adder Subtractor Using IC7483, IC7486	
7	Study of Mod Counters Using IC- 74190,74193	
8	Study of Multiplexer Using IC74151, 74153, 74157.	
9	Study of De Multiplexer Using IC SN74LVC1G19, 74139, 74138, 74154	
10	Study of Encoder Decoder Using IC74HC147, 74139, 74138, 74154	

	Course Code: **MSPHCC103T**	Course Title: **Quantum Mechanics**	
	Course Credit: **4**	Total Contact Hours: 60 Hours	
Sr. No.	**Course Contents (Topics &Subtopics)**		**Reqd. Hours**
1	**Unit I** **General Formalism and Mathematical Tools of Quantum Mechanics: -** Schrödinger Time Dependent Time Independent Equation, Physical Significance of Wave Function, Quantum Numbers, Physical Significance of Eigen Function Eigen Value, Completeness of Eigen Functions, Dirac Delta Function its Properties, Ket Bra Notations, the Linear Vector Space, the Hilbert Space, Dimension Basis of a Vector Space, Linear Operators, Commutation Relation for Position Momentum Operator, Hermitian Operators Properties, Matrix Representation of Kets, Bras, Operators, Change of Bases Unitary Transformations, Matrix Representation of the Eigenvalue Problem, Parity Operator its Eigenvalues, Matrix Mechanics Wave Mechanics, Postulates of Quantum Mechanics, the State of a System - Probability Density the Superposition Principle, Observables Operators, Expectation Values, Connecting Quantum to Classical Mechanics – Poisson brackets commutators, the Ehrenfest theorem, Quantum Mechanics and Classical Mechanics.		**15 Hours**
2	**Unit II** **Angular Momentum:** Orbital Angular Momentum, Commutation Relations for Spin, Orbital total Angular Momentum Ladder Operators, Eigen Values of L^2, L_z, J^2, J_z, J_-, Angular Momentum Rotations, Rotational Symmetry Conservation of Angular Momentum, Reflection Invariance Parity, Addition of Angular Momentum-General Formalism, Clebsch Coefficient for J_1=J2=1/2, J_1=1 J_2=1/2, Angular Momentum Matrices, Pauli Spin Matrices, Spin Eigen functions, Free Particle Wave function Including Spin, Addition of two Spins.		**15 Hours**
3	**Unit III** **Approximation Methods:** (a) Time Independent Perturbation Theory: Non-Degenerate Case- First Order Perturbations, Second Order Perturbation, Application for the He Atom, Degenerate Perturbation Theory Stark Effect. (B) Time dependent Perturbation Theory: Zero Order Perturbation, First Order Perturbations, Second Order Perturbation, Fermi Golden Rule, Adiabatic and Sudden Approximation. the Pictures of Quantum Mechanics - the Schrödinger Picture, the Heisenberg Picture, the Interaction picture (C) Variational Method: The Basic Principle, Application for He Atom (D) WKB Approximation: The Classical Limit, One Dimensional Case, Connection Formulae, The Turning Point Application to Barrier Potential.		**15 Hours**
4	**Unit IV** **Theory of Scattering:** Relation Between Angles and Cross Section in Laboratory and Centre of Mass Reference Frames, Scattering Amplitude, Differential Total Scattering Cross Section, Scattering by Spherically Symmetric Potentials, Integral Equation of Scattering. The Born Approximation, Partial Wave		**15 Hours**

	Analysis Phase Shifts, Optical Theorem, Scattering by a Perfectly Rigid Sphere by Square Well Potential, Identical Particles, Identical Particles in Classical Quantum Mechanics Many Particle System- Schrödinger Equation, Interchange Symmetry, Systems of Distinguishable Non-interacting Particles, Constructing Symmetric Asymmetric Wave Factions, Systems of Identical Non-interacting Particles.	
	Suggested Readings:	
	1. Quantum Mechanics Concepts Applications by Nouredine Zettili, Wiley Publications. 2. Introduction to Quantum Mechanics by D. J. Griffiths, Phi Learning Pvt. Ltd. 3. Introductory Quantum Mechanics by Richard Lib off, Pearson. 4. Quantum Mechanics by G. Aruldhas (Phi Learning Private Limited). 5. Quantum Mechanics by Gupta, Kumar, Sharma (Jai Prakash Nath & Co. Meerut). 6. Quantum Mechanics by Satya Prakash.	
	Course Outcomes:	
	by way of studying Quantum Mechanics the students can have an insight into the understanding of physical phenomenon since most of the phenomenon in Solid State Physics, atomic molecular physics, nuclear physics have been explained were placed as firm footing using Quantum Mechanical explanation. They will also have knowledge about the approximation methods studied in this course which is now-a-days used in various molecular modelling softwares.	

	Course Code: **MSPHLB103P**	Course Title: **Lab Course-3** Minimum Number of Experiments to be Performed Reported in the Journal = **04**
	Course Credit: **2**	Total Contact Hours: 60 Hours
Sr. No.	**Course Contents (Topics &Subtopics)**	
1	Study of He-Ne Laser Measurement of Divergence Wavelength.	
2	h/e by Photocell.	
	DC Hall Effect.	
3	Solar Cell.	
4	Characteristics of a Geiger Muller Counter Measurement of Dead Time.	
5	Michelson's Interferometer.	
6	Measurement of Dielectric Constant, Curie Temperature Verification of Curie Weiss Law for Ferroelectric Material.	
7	Analysis of Sodium Spectrum	
8	Barrier Capacitance of Junction Diode	
9	Carrier Lifetime by Pulsed Reverse Method	
10	Potentials Fields Near Electric Charges, Poisson's Equation Using OCTAVE/SCILAB/MATLAB	
11	Time Independent Schrodinger Equation. Shooting Method Using OCTAVE/SCILAB/MATLAB	
12	Wavepacket Construction Using OCTAVE/SCILAB/MATLAB	

	Course Code: **MSPHIE101T**	Course Title: **Solid State Physics**	
	Course Credit: **4**	Total Contact Hours: 60 Hours	
Sr. No.	**Course Contents (Topics &Subtopics)**		**Reqd. Hours**
1	**Unit-I** **Diffraction of Waves by Crystals and Reciprocal Lattice:** Bragg Law, Scattered Wave Amplitude Fourier Analysis, Reciprocal Lattice Vectors, Diffraction Conditions, Brillouin Zones, Reciprocal Lattice to SC, BCC FCC Lattice. Interference of Waves, Atomic form Factor, Elastic Scattering by Crystal, Ewald Construction, Structure Factor, Laue Method, Rotating Crystal Method, Powder Method of X-Ray Diffraction.		**15 Hours**
2	**Unit-II** **Lattice Vibrations and Thermal Properties:** Vibrations of Monoatomic Lattice, Normal Mode Frequencies, Dispersion Relation. Lattice with two Atoms per Unit Cell, Normal Mode Frequencies, Dispersion Relation, Quantization of Lattice Vibrations, Phonon Momentum, Inelastic Scattering of Neutrons by Phonons, Surface Vibrations, Inelastic Neutron Scattering. Anharmonic Crystal Interaction. Thermal Conductivity Lattice Thermal Resistivity, Umklapp Process, Imperfections.		**15 Hours**
3	**Unit III** **Semiconducting and Superconducting Properties:** **Semiconductors**: Energy B Gap, Effective Mass, Intrinsic Carrier Concentration, Conductivity of Semiconductors, Impurity Levels in Doped Semiconductors. **Superconductors**: Critical Temperature, Meissner Effect, Type-I Type-II Superconductors, BCS Theory of Superconductivity, Flux Quantization, Josephson Effect, Squid, High-Tc Superconductivity.		**15 Hours**
4	**Unit IV** **Dielectric and Magnetic Properties:** Dielectrics: Polarization Mechanism, Dielectric Constant, Lorenz Cavity Field, Clausius Mossotti Relation, Ferroelectricity, Polarization Catastrophe, Types of Ferroelectrics, Piezoelectrics. Magnetics: Theory of Diamagnetism, Classical Quantum Theories of Paramagnetism, Exchange Interactions, Magnetic Order (Ferro Anti Ferro Ferrimagnetism), Weiss Theory of Ferromagnetism, Ferromagnetic Domains.		**15 Hours**
	Suggested Readings:		
	1. Charles Kittel "Introduction to Solid State Physics", 7th Edition John Wiley &Sons. 2. Solid State Physics by a. J. Dekker, Macmillan India Ltd. (1986). 3. M. A. Wahab "Solid State Physics –Structure Properties of Materials" Narosa Publications 1999. **4.** M. Ali Omar "Elementary Solid State Physics" Addison Wesley (LPE). **5.** H. Ibach H. Luth 3rd Edition "Solid State Physics an Introduction to Principles of materials Science" Springer.		
	Course Outcomes:		

	on completion of the course, the student shall be able to explain the basic concepts that are used to describe the structure physical properties of crystalline substances, use physical models to perform calculations of the properties of solids, understand the phenomenon of dielectric magnetic materials etc.	

	Course Code: **MSPHLB104P**	Course Title: **Lab Course -4** Minimum Number of Experiments to be Performed Reported in the Journal = **04**
	Course Credit: **2**	Total Contact Hours: 60 Hours
Sr. No.	**Course Contents (Topics &Subtopics)**	
1	JFET Characteristics	
2	Static Characteristics of SCR.	
3	Design, Build Test Astable /Monostable Multivibrator Using IC741/ IC555.	
4	Design, Build Test First Order &Second Order Low Pass Filter Using IC741.	
5	Design of Regulated Power Supply Study its Line Load Regulation Using ICLM317.	
6	Voltage to Frequency / Frequency to Voltage Converter Using Op-Amp	
7	Design, Build Test the Temperature to Frequency Converter Using IC741/IC 555..	
8	FET Characteristics Designing of Amplifier.	
9	TTL Characteristics.	
10	Delayed Linear Sweep Using IC 555.	

	Course Code: **MSPHGE101T**	Course Title: **Scientific Programming Languages**	
	Course Credit: **2**	Total Contact Hours: 30 Hours	
Sr. No.	**Course Contents (Topics & Subtopics)**		**Reqd. Hours**
1	**Unit I**		**8 Hours**
	Brief Review of Scientific Computing Language-OCTAVE, MATLAB, SciLab etc. **Environment of Scientific Programming:** Local Environment Setup, Variables - Creating Variables, Special Variables Constants, Over writing Variable, Error Messages, Making Corrections. Data Types - Data Types Available, Data Type Conversion, Determination of Data Types, Numbers, Conversion to Various Numeric Data Types, Smallest Largest Integers, Smallest Largest Floating-Point Numbers. Commonly Used Operators, Arithmetic Operators, Relational Operators, Logical Operators, Bitwise Operations, Set Operations, Special Characters, Controlling the Hierarchy of Operations or Precedence, Controlling the Appearance of Floating-Point Number. Work Space - Managing the Workspace, Keeping Track of Your Work Session, Entering Multiple Statements Per Line.		
2	**Unit II**		**8 Hours**
	Array Operations Matrix Generation: Array Functions- Length, Dimension Number of Elements, Circular Shifting of the Array Elements, Sorting Arrays, Cell Array, Accessing Data in Cell Arrays. Strings, Rectangular Character Array, Combining Strings into a Cell Array. Vectors - Creating Vectors, Row Vectors, Column Vectors. Matrix - Creating Matrices, Vector, Matrix Indexing, Colon Operator, Linear Spacing, Colon Operator in a Matrix, creating a Sub-Matrix, Deleting Row or Column, Dimension, Continuation, Transposing a Matrix, Concatenating Matrices, Matrix Functions, Matrix Generators, Special Matrices. Matrix Arithmetic Operations, Array Arithmetic Operations, Matrix Inverse.		
3	**Unit III**		**7 Hours**
	Scripts File: File, Creating Saving Script File, Running Script File, Current Directory, Search Path. Scope of Variables, Passing Parameters, Global Variables. Input to Script File Output Script File, Output Commands, the *disp Command*, the *fprintf Command*, Opening Closing Files, Writing Formatted Output Files, Reading Formatted Data from Files. Debugging Files, Debugging Process, Preparing for Debugging, Setting Breakpoints, Running with Breakpoints, Examining Values, Correcting Ending Debugging, Ending Debugging, Correcting File.		
4	**Unit IV**		**7 Hours**
	Function Files: Functions, Anonymous Functions, Primary Sub-Functions. Recursive Functions, String Functions. Creating a Function File, Structure of Function File, Function Definition Line, Input Output Arguments, The H1 Line Help Text Lines, Function Body, Local Global Variable, saving		

	a Function File, Using a Function Example of Simple Function File, Comparison Between Script File Function Files, Inline Function, the *feval Command*.	
	Suggested Readings	
	1. Programming in MATLAB by Marc E. Hermitter, Thomson Brooks. 2. MATLAB Programming by Rudrapratap. D. Attaway, S. 3. a Practical Introduction to Programming Problem Solving. Edition/Publisher: Third Edition. Elsevier. San Fransisco. 4. MATLAB: a Practical Introduction to Programming Problem-Solving Book by Stormy Attaway, Paperback ISBN: 9780128154793 Elsevier.Com. 5. MATLABfor Beginners a Gentle Approach Revised Edition Peter I. Kattan Petra Books. 6. Getting Started with MATLAB: A Quick Introduction for Scientists &Engineers Paperback – 1 January 2010 by Rudra Pratap (Author). 7. MATLAB Programming for Engineers 6th Edition by Stephen J Chapman, Cengage India. 8. MATLABwith Applications to Engineering, Physics Finance Hardcover – Import, 30 October 2009 by David Baez-Lopez (Author). 9. Scientific Computing With Matlab And Octave 4Th Edition by Alfio Quarteroni and Paola Gervasio and Fausto Saleri, SPRINGER. 10. Introduction to Octave: For Engineers and Scientists by Sandeep Nagar 11. MATLAB Guide, Third Edition Desmond J. Higham, Nicholas J. Higham. 12. MATLABfor Engineering Applications William Palm. 13. Advanced Programming in Scilab, by Jain. 14. Scilab A Beginner'S Approach by Anil Kumar Verma, Cengage India. 15. Scilab from Theory to Practice - I. Fundamentals (English, Paperback, Roux Philippe). 16. Octave/Matlab Primer and Applications, by Nakamura S. 17. Programming for Computations - MATLAB/Octave, by Linge Svein, Publisher: Springer International Publishing AG	
	Course Outcomes:	
	After successful completion of the course student will be familiar with the basics of Scientific Programming and its environment. Students will understand basics of Scientific Programming, operators' special characters. They will also understand, commands, workspace using windows and will also create rows, columns of matrices, arrays. They will understand how to use files, functions in Scientific Programming.	

	Course Code: MSPHAE101T	**Course Title: Digital Electronics**	
	Course Credit: 2	Total Contact Hours: 30 Hours	
Sr. No.	**Course Contents (Topics &Subtopics)**		**Reqd. Hours**
1	**Unit I** **Multiplexers and Demultiplexers:** Multiplexer: Types of Multiplexers2:1, 4:1, 8:1 16:1, Encoders,Parity Checker, Parity Generators, Code Converters, Magnitude Comparator.De-Multiplexer : Types of Demultiplexers 1:2,1: 4, 1:8 1:16, Decoder IC7445, 7447, 74138, Implementation of K-Map on Combinational Circuits.		**8 Hours**
2	**Unit II** **Flip Flops:** Introduction to Flip Flops, Bi-Stable Multi-Vibrator, RS Flip- Flop, D-Type Flip-Flop Using RS- Flip-Flop, Edge Triggering, Level Triggering, JK- Flip - Flop - JK Master Slave Flip - Flops, D-Type Flip-Flop Using JK- Flip-Flop.		**7 Hours**
3	**Unit III** **Shift Registers:** Introduction to Shift Registers, Types of Shift Registers, SIPO, PISO, SISO, PIPO, Universal Shift Operations Using Various ICs, Controlled Buffers, Unidirectional &Bidirectional Controlled Buffers. Implementation of K-Map on Sequential Circuits.		**7 Hours**
4	**Unit IV:** **Counters** Types of Counters, Asynchronous, three-Bit Ripple Counter, Asynchronous Up / Down Counter, Modulus of Counter (Examples Mod-2, Mod-4, Mod-10, Mod-12, Mod-16 Counters). Cascaded Ripple Counter, Synchronous Counters, three-Bit Synchronous Counters, Synchronous Up / Down Counters, Designing of Synchronous Counters Using K-Maps.		**8 Hours**
	Suggested Readings		
	1. Handbook of Electronics, Gupta Anand Kumar. 2. Digital Principles Applications by Malvino Donald P Leach Albert Paul Malvino. 3. Modern Digital Electronics, R.P. Jain, 4th Edition, Mc Graw Hill. 4. Digital Fundamentals by Morris Mano, Phi Publication. 5. Digital Fundamentals Thomas L. Floyd, 10th Edition, Pearson. 6. Digital Electronics by Anil Kumar Maini. 7. Fundamentals of Logic Design by Charles H. Roth Thomson.		
	Course Outcomes:		
	After successful completion of the course student will be able analyse design digital combinational circuits multiplexers demultiplexers design and implementation of combinational circuits. Designing implementation of flip flop and applications of flip flop. Designing implementation of shift registers, synchronous, asynchronous and sequential circuits.		

Semester–II

	Course Code: **MSPHCC201T**	Course Title: **Electronics**	
	Course Credit: **4**	Total Contact Hours: 60 Hours	
Sr. No.	**Course Contents (Topics &Subtopics)**		**Reqd. Hours**
1	**Unit I** **Semiconductors:** Brief Idea About B Theory of Semiconductor, Conduction Mechanism, Carrier Concentration Mobility, Effect of Temperature on Electrical Conductivity, Intrinsic Semiconductors, Carrier Concentration in an Intrinsic Semiconductor, Conduction Valance Band, Carrier Concentration in Terms of Band Gap, Electrical Conductivity, Generation Recombination of Charges, Extrinsic Semiconductor- P Type N Type,		**15 Hours**
2	**Unit II** **Semiconductor Devices:** BJT, Field Effect Transistors-JFET, MOSFET Related Devices, MESFET- Device Structure Working. Switching Characteristics of Transistor, Astable, Monostable Bistable Multivibrators, Special Purpose Diodes Other Devices: LED, Schottky, Varactor, Tunnel, Photo Diodes, Photoconductive Cell, LCD (Liquid Crystal Display), Solar Cell, Thermistor, SCR, UJT, Photo Transistor.		**15 Hours**
3	**Unit III** **Operational Amplifier:** Block Diagram of a Typical Op-Amp its Characteristics, Applications of Op-Amp - DCAC Amplifier, Summing, Scaling Averaging Amplifiers, Instrumentation Amplifier, Integrator Differentiator, Function Generator Using two OPAMP with Variable Controls, Astable Monostable Multivibrators Using OPAMP, **Timer IC 555**: Applications as PAM, PWM, FM FSK Generator. **Phase Locked Loop (IC 565)**: Block Diagram Working Applications as Fm Detector, FSK Detector, Frequency Multiplier Frequency Translator. Voltage Controlled Oscillator (IIC 566): Block Diagram Working. **Oscillator:** Principles, Oscillator Types, Frequency Stability, Response, Phase Shift Oscillator, Wein Bridge Oscillator, L C Tuneable Oscillator.		**15 Hours**
4	**Unit IV** **Logic Gates, Boolean Algebra, Minimization Technique and K-Maps:** Basic Logical Operation Like or, Not, Derived Logic Operations Like N, Nor, Ex-or, Ex-Nor. Boolean Algebraic Methods, Rules, Limitations, De-Morgan's Theorem, Boolean Expression, N–Nor Implementations, Simplification of Logic Operations Using Boolean Algebra De Morgan's Theorems, 1's, 2's Complementation 1's, 2's Complementation Subtraction Methods. Binary Codes Like BCD Code, Gray Code, Excess-3 Code. Minimization of Boolean Expressions, Minterms, Maxterms, Sum of Products (SOP), Product of Sums (POS), Karnaugh Map (K-Map), Minimization, Don't Care Conditions. **Combinational Circuits:** Half Adder, Full Adder, Half Subtractor, Full Subtractor, Parallel Binary Adder, Parallel Binary Subtractor, Four-Bit Binary Adder/Subtractor.		**15 Hours**

	Suggested Readings	
	1. Power Electronics Circuits, Devices Applications, 3rd Edition by Muhammad H. Rashid, Pearsons Publications 2. Electronic Devices Circuits: An Introduction by Allen Mottershed 3. Hbookof Electronics, Gupta Kumar. 4. Solid State Electronic Devices, 6th Edition, by Ben G. Streetman 4. Operational Amplifiers, 5th Edition by G.B. Clayton. 5. Linear Integrated Circuits, 4th Edition by Roy Choudhari. 6. Design withOPAMPs Analog Integrated Circuits by Sergio Franco. 7. Op-Amps Linear Integrated Circuits, Ramakant a.Gayakwad, Phi Learning Private Limited. 8. Digital Electronics by R.P. Jain. 9. Digital Principles &Applications‖ by Albert P Malvino Leach, Tata McGraw-Hill Delhi, 8thEdition, 2015. 10. Digital Electronics: An Introduction to Theory Practiceby W.H. Gothman. 11. Digital Design by M. Morris Mano, Michael D. Ciletti, Pearson Education Asia, 4 Th Edition 2011 / International Edition 2013. 12. Digital Fundamentals Thomas L. Floyd, 10th Edition, Pearson	
	Course Outcomes:	
	After Successful Completion of the Course Student will be able to Analyse Semiconductors, Types of Semiconductors, Charge Mobility in Semiconductors. Student will Understand the Concept of Semiconductor Devices, Types of Semiconductor Devices Their Applications. Students will Analyse Characteristics Applications of OPAMP, Students will Demonstrate Knowledge of 555 Timer Design Analyse of Electronic Circuits Using OPAMP. Students Also Analyse Implementation of OPAMP as an Oscillators, Students Can Design Implement Combinational Logic Circuits Simplification of Logic Circuits Using Boolean Identities, Laws Rules. Student Also able Implement K-Map Simplifications of Logic Arithmetic Combinational Circuits.	

	Course Code: **MSPHLB201P**	Course Title: **Lab Course -5** Minimum Number of Experiments to be Performed Reported in the Journal = 04
	Course Credit: **2**	Total Contact Hours: 60 Hours
Sr. No.	**Course Contents (Topics &Subtopics)**	
1	Function Generator Using IC-8038.	
2	PLL Application Using IC 565.	
3	Study of 8 Bit DAC.	
4	Design, Built Test Oscillator – Wien Bridge Oscillator / Phase Shift Oscillator Using Op-Amp.	
5	Constant Current Source Using Op-Amp	
6	To Observe the Characteristics of UJT Relaxation Oscillator	
7	SCR Digital Triggering Circuit for a Single Phase Controlled Rectifier AC Voltage Regulator.	
8	Instrumentation Amplifier with Thermocouple Transducer Ad-590.	
9	Capacitance Measurement Using IC555.	
10	Microwave Oscillator Characteristics.	

	Course Code: **MSPHCC202T**	Course Title: **Electrodynamics**	
	Course Credit: **4**	Total Contact Hours: 60 Hours	
Sr. No.	**Course Contents (Topics &Subtopics)**		**Reqd. Hours**
1	**Unit I**		**15 Hours**
	Maxwell's Equations, Energy in Electromagnetic Fields (Poynting Theorem),Electromagnetic Waves in Free Space, Matter, Non-conducting Media (Isotropic Dielectric), Anisotropic Dielectric, Conducting Media, Ionized Gases. Polarization of Electromagnetic Waves, Skin Depth.		
2	**Unit II**		**15 Hours**
	Interaction of Electromagnetic Waves with Matter: Boundary Conditions for Electromagnetic Field Vectors at the Interface Between two Media, Reflection Refraction at the Boundary of two Non-Conducting Media, Plane Incidence, Oblique Incidence, Propagation of EM Waves Between Parallel Conducting Planes, Waveguides, TE, TM, TEM Mode, Rectangular, Circular Waveguide, Scattering by a Bound Electron (Rayleigh Scattering), Coherence Incoherenceof Scattered Light.		
3	**Unit III**		**15 Hours**
	Inhomogeneous Wave Equation: Electrodynamic Potentials, Gauge Transformation, Lorentz Gauze, Hertz Vector Electro Gauge, Coulomb Gauge, Retarded Advanced Potentials, Electromagnetic Potentials in Electric Magnetic Fields, Hertz Solution of Wave Equation.		
4	**Unit IV**		**15 Hours**
	The Fields of Moving Charges: Retarded Potentials: Lienard-Wiechert Potentials, Radiation Produced by an Oscillating Electric Dipole, Radiation Due to Small Current Element, Half Wave Antenna, Covariant Formulation of Electrodynamics: Energy Momentum Tensors.		
	Suggested Readings		
	1. Introduction to Electrodynamics, D. J. Griffiths (Prentice Hall). 2. Classical Electrodynamics, J. D. Jackson (John Wiley). 3. Classical Theory of Fields, L.D. Lau E.M.Lifshitz(Addison- Wesley). 4. Electrodynamics of Continuous Media, L.D. Lau E. M. Lifshitz (Addison-Wesley). 5. Electrodynamics, a. Somerfield (Academic Press, Freeman co.). 6. Classical Electricity Magnetism, W.K.H. Panofsky M.Phillips (Addison-Wesley). 7. Feynman Lecturesvol. II. R. P. Feynman, Leighton S S(Narosa). Berkeley Seriesvolume II, E. M. Purcell (McGraw-Hill). 8. Electricity Magnetism, Reitz, Milford Christy (Pearson). 9. Introduction to Electrodynamics, A. Z. Capri P.V. Panat (Narosa Publications). 10. Electrodynamics- Gupta, Kumar, Singh.		
	Course Outcomes:		
	The Students will be able to Understand the Significance of Maxwell's Field Equations, The Electromagnetic Waves in Free Space Matter, The Interaction of Electromagnetic Waves with Matter, Inhomogeneous Wave Equation, Field of Moving Charges the Covariant Formulation of Electrodynamics.		

	Course Code: MSPHLB202P	**Course Title: Lab Course-6** Minimum Number of Experiments to be Performed Reported in the Journal = **04**
	Course Credit: **2**	Total Contact Hours: 60 Hours
Sr. No.	**Course Contents (Topics &Subtopics)**	
1	Lattice Parameter &Particle Size Determination.	
2	Skin Depth in Al Using Electromagnetic Radiation.	
3	To Determine the Transition Capacitance of a Varactor Diode Use it as a Variable Capacitor.	
4	End Point Energy Absorption Coefficient Using G. M. Tube.	
5	'E' by Millikan Oil Drop Method.	
6	Zeeman Effect.	
7	Measurement of Refractive Index of Liquids Using Laser.	
8	Energy B Gap of Semiconductor Using Four Probe Method.	
9	I-V/ C-V Measurement on Semiconductor Specimen.	
10	To Study the Nature of Polarization of Laser Light Using Photo Cell Quarter Wave Plate.	
11	Fabry-Parot Etalon.	
12	Study of Magneto Resistance in Semiconductors.	
13	Time Independent Schrodinger Equation. Shooting Method Using OCTAVE/SCILAB/MATLAB	
14	Wavepacket Construction Using OCTAVE/SCILAB/MATLAB	
15	Determination of Eigen Values Eigen Vectors of a Square Matrix Using OCTAVE/SCILAB/MATLAB	

	Course Code: **MSPHCC203T**	Course Title: **Atomic and Molecular Physics**	
	Course Credit: **4**	Total Contact Hours: 60 Hours	
Sr. No.	**Course Contents (Topics &Subtopics)**		**Reqd. Hours**
1	**Unit I** **The Atom Model for two Valence Electrons:** Coupling Schemes: L-L Coupling, S-S Coupling, LS or Russell - Saunder's Coupling; The Pauli Exclusion Principle, Coupling Schemes for two Electrons, Tau-Factors for LS Coupling, Le Interval Rule, JJ-Coupling, Branching Rules, Selection Rules. Spectral Terms, Hund's Rule, Steren-Gerlach Experiment.		**15 Hours**
2	**Unit II** **Zeeman Effect, Paschen-Back Effect and Stark Effect:** Electronic Spectroscopy of Atoms, The Magnetic Moment of the Atom, Zeeman Effect for two-Electrons, Intensity Rules for Zeeman Effect, Paschen-Back Effect for two Electrons, Stark Effect of Hydrogen, Weak Field Stark Effect in Hydrogen, Strong Field Stark Effect in Hydrogen, Origin of Hyperfine Structure.		**15 Hours**
3	**Unit III** **Microwave Spectroscopy:** Classification of Molecules: Linear, Symmetric Tops, Spherical Tops, Asymmetric Tops; Rotational Spectra: The Rigid Diatomic Molecule, The Non-Rigid Rotator, Spectrum of a Non-Rigid Rotator, Selection Rules, Chemical Analysis by Microwave Spectroscopy, Techniques Instrumentation of Microwave Spectroscopy.		**15 Hours**
4	**Unit IV** **Infra-Red Spectroscopy:** The Energy of a Diatomic Molecule, The Simple Harmonic Oscillator, The Anharmonic Oscillator, The Diatomic Vibrating-Rotator, Analysis by Infra-Red Spectroscopy, Techniques Instrumentation of Infra-Red Spectroscopy. Raman Effect, Pure Rotational Raman Spectra, Vibrational Raman Spectra, Frank- Condon Principle Applications, NMR Spectrometer, Principle of Electron Spin Resonance (ESR), ESR Spectrometer, Chemical Shift.		**15 Hours**
	Suggested Readings		
	1. Introduction to Atomic Spectra – H.E. White, McGraw Hill (1934). 2. Fundamentals of Molecular Spectroscopy, Edn. 3 – C.N. Banwell, Tata McGraw Hill (1983). 3. Atomic Molecular Spectra: Laser- Rajkumar, Knrn (2012). 4. Spectra of Diatomic Molecules, Vol. I – G. Herzberg, N.J.D. Van Nostrand (1950). 5. Spectroscopy, Vol. I, II, III – B.P. Straughan S. Walker, Chapman Hall (1976). 6. Introduction to Molecular Spectroscopy – G.M. Barrow, McGraw Hill (1962). 7. Molecular Spectroscopy – J.M. Brown, Oxford University Press		

	(1998).	
	Course Outcomes:	
	The Students will be able to Understand Atomic Molecular Interactions, Different Couplings. They will Understand Behaviour of Atoms in External Applied Electric Magnetic Field. Students will be able to Learn Theory of MWIR Spectroscopic Techniques.	

	Course Code: **MSPHLB203P**	Course Title: **Lab Course-7** Minimum Number of Experiments to be Performed Reported in the Journal = **04**
	Course Credit: **2**	Total Contact Hours: 60 Hours
Sr. No.	**Course Contents (Topics &Subtopics)**	
1	BCD-to-Decimal Decoder Converter Using IC74HC42, IC7447.	
2	Code Converter Using IC Using IC-74LS138.	
3	Gun Diode Characteristics.	
4	Differential Amplifier Using Transistor/ OPAMP.	
5	Study of Sample Hold Circuit.	
6	DIAC- TRIAC Phase Control Circuit.	
7	Instrumentation Amplifier its Applications.	
8	Adder-Subtractor Circuits Using ICs.	
9	Draw Input Output Characteristics of a MOSFET.	
10	To Design Op Amp Differentiator Integrator, Generate Sawtooth, Square Rectangular Wave Form.	

	Course Code: **MSPHIE201T**	Course Title: **Numerical Techniques**	
	Course Credit: **4**	Total Contact Hours: 60 Hours	
Sr. No.	**Course Contents (Topics &Subtopics)**		**Reqd. Hours**
1	**Unit I** Elementary Information About Digital Computer, Hardware, Software, Machine Language Program, Assembly Language Program, Assembler, Disadvantages of Machine Assembly Language Programming, High Level Language Programs, Interpreter Compilers, Flow Charts-Symbols Simple Flowcharts, Structure of a C Program, Header Files, Constant Variables, Data Types Their Declarations, Operators Arithmetic Operators, Relational Operators, Logical Operators, Assignment Operators, Conditional Operator. Built in Functions in C, Input / Output Functions for Integer, Floating Points, Characters Strings. Control Statements-If, If-Else, Do-While. for Loop, Nested If Nested for Loops, go to Statement. Library Functions- Mathematical Trigonometric. Arrays- One Dimensional two- Dimensional. User Defined Functions-Definition Declaration of a Function, Passing Arguments, Return Values. File Handling- Operation with Files, Opening Closing a File. (Structures Unions Pointers Are Not Expected)		**15 Hours**
2	**Unit II** Roots of Equation: Polynomial Transcendental Equation, Limits for the Roots of Polynomial Equation, Bisection Method, False Position Method, Newton Raphson Method, Direct Substitution Method. Principle of Least Squares Fit Method, fitting a Straight Line, fitting a Parabola, Fitting an Exponential Curve, Fitting Curve of the Form $Y=Ax^b$. Linear Interpolation, Difference Schemes, Newton's Forward Backward Interpolation Formula, Lagrange's Interpolation Formula.		**15 Hours**
3	**Unit III** Numerical Integration - Newton Cotes Formula, Trapezoidal Rule, Simpson's One Third Rule, Simpson's three Eight Rule, Gauss Quadratics Method, Monte Carlo Method. Solution of Simultaneous Equations: Gaussian Elimination Method, Gaussian Elimination with Pivotal Condensation Method, Gauss-Jordan Elimination Method, Gauss-Seidel Iteration Method, Gauss-Jordan Matrix Inversion Method. Eigenvalues Eigenvectors of Matrices-Power Jacobi Method		**15 Hours**
4	**Unit IV** Solution of Ordinary Differential Equation - Taylor Series Method, Euler's Method, Runge-Kutta Method, Milne's Adams Bashforth Predictor-Corrector Methods. Classification of Second Order Partial Differential Equation, Solution of Partial Differential Equation-Difference Equation Method Over a Rectangular Domain for Solving Elliptic, Parabolic Hyperbolic Partial Differential Equation.		**15 Hours**
	Suggested Readings		
	1. Computer Oriented Numerical Methods, Rajaraman, Phi. 2. Introductory Method of Numerical Analysis, Sastry. 3. Numerical Computational Method, P.B. Patil, U.P. Verma		

	(Narosa Publication New Delhi). 4. Programming in Ansi C, Balgurusamy, Tata Mcgraw Hill. 5. Numerical Methods for Scientists Engineers, by H. M. Antia. 6. Numerical Methods for Scientists Engineers, by H. M. Antia.	
	Course Outcomes:	
	On completion of the course students will be able to apply numerical techniques which have enormous application in the field of science some fields of engineering. The students will be familiar with numerical integration differentiation, numerical solution of ordinary differential equations, solving set of simultaneous equations with c programming.	

	Course Code: **MSPHLB204P**	Course Title: **Lab Course-8** Minimum Number of Experiments to be Performed Reported in the Journal = **04**
	Course Credit: **2**	Total Contact Hours: 60 Hours
Sr. No.	**Course Contents (Topics &Subtopics)**	
1	Write Execute a C Computer Program for Least Squares Fit Method.	
2	Write Execute a C Computer Program for Numerical Integration by Trapezoidal Rule.	
3	Write Execute a C Computer Program for Numerical Integration by Simpson's 1/3rdRule.	
4	Write Execute a C Computer Program for Numerical Integration by Monte Carlo Method.	
5	Write Execute a C Computer Program for Solution of Ordinary Differential Equation by Runge-Kutta Method.	
6	Write Execute a C Computer Program to Read two Matrices from a File, Store Them in a two-Dimensional Array, Take Their Multiplication Store Result in a File.	
7	Write Execute a C Computer Program to Find a Root ofa Given Equation Using Bisection Method.	
8	The Pendulum: Solution Using the Euler Method Using OCTAVE/SCILAB/MATLAB	
9	Kepler's Laws Using OCTAVE/SCILAB/MATLAB	
10	The Pendulum: Solution Using the Euler Method Using OCTAVE/SCILAB/MATLAB	
11	Determination of Roots of Polynomials MATLAB.	
12	Determination of Frequency Response of a Transfer Function Using OCTAVE/SCILAB/MATLAB	

	Course Code: **MSPHSE201T**	Course Title: **Renewable Energy Sources**	
	Course Credit: 4	**Total Contact Hours: 60 Hours**	
Sr. No.	**Course Contents (Topics &Subtopics)**		**Reqd. Hours**
1	**Unit I**		**15 Hours**
	Introduction to Energy Sources: Energy Consumption as Measure of Prosperity, World Energy Future, Fossil Fuels Their Availability, Non-Conventional Energy Sources: Solar Energy, Wind Energy, Biomass Energy, **Solar Energy**: Sun as the Source of Energy its Energy Transport to the Earth, Extra-terrestrial, Terrestrial Solar Radiations, Solar Spectral Irradiance, Solar Radiation Geometry, Measurement Techniques of Solar Radiations, Estimation of Average Solar Radiation.		
2	**Unit II**		**15 Hours**
	Solar Thermal Solar and Photovoltaic Systems: Solar Thermal Systems: Solar Collectors, Solar Water Heaters, Solar Heating Cooling, Solar Refrigeration Air Conditioning, Solar- Cookers, Dryers, Distillation. Solar Photovoltaic: Solar Cell, Characteristics of Solar Cell, Solar Cell Array Panel Construction, PV Systems Applications.		
3	**Unit III**		**15 Hours**
	Wind Energy Geothermal Energy: **Wind Energy:** Origin Classification of Winds, Aerodynamics of Windmill: Maximum Power, Forces on the Blades Thrust on Turbines; Wind Data Collection Field Estimation of Wind Energy, Site Selection, Basic Components of Wind Mill, Types of Wind Mill, Wind Energy Farm, Hybrid Wind Energy Systems: Wind + Pv; the Present Indian Scenario. **Geothermal Energy:** Origin Distribution of Geothermal Energy, Types Analysis of Geothermal Resources, Exploration Development of Geothermal Resources, Applications, Geothermal Energy in India.		
4	**Unit IV**		**15 Hours**
	Ocean Energy and Miscellaneous Non-Conventional Energy Sources: Tidal Energy, Wave Energy, Ocean Thermal Energy Conversion, Magneto Hydrodynamic Power Conversion, Thermoelectric Power Conversion, Thermionic Power Conversion, Fuel Cells, Hydrogen Energy.		
	Suggested Readings		
	1. Energy Sources" by G. D. Rai, Khanna Publications. **2.** Non-Conventional Energy Resources, by B. H. Khan, McGraw Hill Education. **3.** Solar Energy, by S P Sukhatme, J K Nayak, McGraw Hill Education.		
	Course Outcomes:		
	After completion of the course students will able o understand the different energy sources, renewable energy its importance. They will be exposed to the use of solar wind energy. Students will learn ocean geothermal energy how it will be harvested. Understanding of different energy technologies will also be covered.		
