Department of Physics
Semester II
Condensed Matter Physics (Core – IV)
Subject Code: PP1721

Teaching Plan

Unit	Modules	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I	**Fundamentals of Dynamics**					
	1	Structure of solid matter: The crystal lattice, Point symmetry, Point groups, The significance of symmetry, Simple crystal structure	**4**	To acquire knowledge on crystal structure	Lecture Discussion with PPT illustration	Evaluation through short test Multiple choice questions Formative assessment I
	2	Reciprocal lattice and determination of crystal structure, Bragg's law, Reciprocal lattice vectors, Construction, Diffraction condition	**4**	To know the principles involved in diffraction	Lecture discussion with PPT illustration	
	3	Brillouin zone, structure factor and atomic form factor, Measurement of diffraction pattern of crystal: The Ewald construction, Rotation method	**4**	To be able to draw the Brillouin zones in different zone schemes	Lecture discussion	
	4	Rotation method, Powder method, Determination of lattice constants	**3**	To be able to determine the lattice constants of solid materials	Lecture discussion	
II	**Phonons**					
	1	Vibration of crystals with mono-atomic basis, Two atoms per primitive basis	**4**	To understand the concept of lattice vibration.	Lecture Illustration	Short test Quiz
	2	Quantization of elastic waves, Phonon momentum, Inelastic scattering by Phonons, Phonon heat capacity, Planck distribution, Normal mode enumeration	**4**	To acquire knowledge on scattering by phonons and phonon heat capacity	Lecture discussion	Assignment Formative assessment I

	3	Density of states in one dimension, Density of states in three dimension	**4**	To be able to determine the density of states	Lecture discussion	
	4	Debye model for Density of states, Debye T^3 law	**3**	To understand Debye model for density of states	Lecture Illustration	
III	**Energy Bands and Semiconductor crystals**					
	1	Electronic band structure of solids, Nearly free electron model, Block functions	**5**	To acquire knowledge on Electronic band structure	Lecture with PPT Illustration	Short test Quiz Formative assessment II
	2	Kronig Penny model, Wave equation of electron in a periodic potential	4	To acquire knowledge on wave equation of electrons in a periodic potential	Lecture with PPT Illustration	
	3	Number of orbitals in a band, Insulators, semiconductors and metals.	4	To acquire knowledge on number of orbitals in a band	Lecture with PPT Illustration	
	4	Band gap, Equations of motion, Effective mass, Physical interpretation of effective mass, Effective mass in semiconductors	5	To understand the concept of effective mass	Question-answer session Lecture	
IV	**Magnetism**					
	1	Diamagnetism: Langevin diamagnetism equation, Quantum theory of diamagnetism of mononuclear systems, Quantum theory of paramagnetism	4	To know the quantum theory involved in Dia and Para magnetism	Lecture Discussion	Formative assessment II
	2	Hund rules, Ferromagnetic order, Curie point and the exchange Integral, Temperature Dependence of the Saturation Magnetization	4	To acquire knowledge on ferromagnetic order	Lecture Discussion	
	3	Magnons, Thermal Excitation of Magnons	3	To acquire knowledge on magnons and their thermal excitation	Lecture Discussion	

	4	Ferrimagnetic order, Antiferro magnetic order, Ferro magnetic domains	5	To acquire knowledge on ferrimagnetic order and ferro magnetic domains	Brain storming session. Lecture Discussion	
V	**Superconductivity**					
	1	Superconductivity: Experimental survey, Occurrence of superconductivity, Destruction of superconductivity by magnetic fields	3	To understand the significance of superconductors	Lecture with PPT	Short test Formative assessment III
	2	Meissner effect, Critical temperature, Heat Capacity, Energy gap, Isotope effect	3	To understand the properties of superconductors	Lecture Illustration	
	3	Thermodynamics of the superconducting transitions, London equations, Coherence Length, BCS theory, Flux quantization in a superconducting ring, Duration of persistent currents	4	To know the theory involved in superconductors	Lecture with PPT Illustration	
	5	Type II super conductors Single Particle Tunneling, DC and AC Josephson effects, High temperature super conductors	4	To acquire knowledge on high temperature superconductors	Lecture with PPT	

Course instructor: Dr. V. Shally **Head of the Department:** Dr. S. Mary Delphine

Semester : II

Name of the Course :a. Crystal Growth Techniques and Thin Films Technology

Subject code : PP1724

Teaching Plan

Unit	Modules	Topics	Lecture hours	Learning outcome	Pedagogy	Assesment/ Evaluation
I	**Crystal growth theories**					
	1	Nucleation, Theories of nucleation, Classical theory of nucleation, Kinetics of Crystal Growth:	4	Understand the theory and kinetics of crystal growth	Illustration, Descriptive lecture	Evaluation through: quiz,
	2	Singular and rough faces,	4	To understand	Illustration and	

		Models on surface roughness		models on surface roughness	theoritical derivation	short questions
	3	The Kossel StranskiVolmer (KSV) theory, The Kossel StranskiVolmer (KSV) theory-formulation	4	To understand the KSV theoritical formulation	Illustration and theoritical derivation	Descriptive answers
	4	The Burton Cabrera Frank (BCF) theory, The Burton Cabrera Frank (BCF) theory-formulation	4	To understand the BCF theoritical formulation	Illustration and theoritical derivation	Formative assessment (I)
II	**Solution growth**					
	1	Low temperature solution growth , Solution, solubility and super solubility, Expression for super saturation	3	To understand factors relaated to crystal growth	Illustration, Descriptive lecture,	Evaluation through: quiz,
	2	Methods of crystallization, Crystal Growth System Classification, Constant temperature bath, Crystallizer-Attraction assembly, Seed, seed mount platform and crystal revolution unit	3	To analyse the principle , working of instruments involved in crystallization	PPT Illustration, Descriptive lecture, comparative study	short questions Descriptive answers
	3	High temperature solution growth: Introduction, Principles of flux growth	3	To identify different techniques for the growth of crystals	Illustration, lecture, comparative study	Assignment
	4	Gel Growth:Introduction ,Principle, Various types of gel, Structure of gel – Growth of crystals in gels, Experimental procedure – Biological crystallization.	4	Apply different techniques for the growth of crystals	PPT Illustration, Descriptive lecture	Formative assessment (I&II)
III	**Hydro thermal and melt growth**					
	1	Hydrothermal Growth: Design aspects of autoclave, Design aspects of autoclave(low, high pressure method)	4	Understand the hydrothermal growth method using autoclaves	Illustration, Descriptive lecture	Evaluation through: quiz,
	2	Melt growth: Growth from the melt, The Bridgman and related techniques	4	To identify the various factors related to Bridgman and related techniques	Illustration, Descriptive lecture	short questions Descriptive answers
	3	Crystal pulling, Convection in melts	4	Understand the Crystal pulling processinvolved in crystal growth	Illustration, Descriptive lecture	Formative assessment

						(II)
IV	**Thin Film technology**					
	1	Nature of film, Deposition technology, Electron beam method, Deposition technology, Electron beam method	4	To identify the various thin film deposition technology	PPT Illustration, Descriptive lecture	Evaluation through: quiz, short questions Descriptive answers Assignment Formative assessment (II&III)
	2	Cathodic sputtering, Chemical vapour deposition, Epitaxial deposition	4	To understand the various thin film deposition technology	lecture, comparative study	
	3	Chemical deposition, Spray pyrolysis process	3	To understand the various thin film deposition technology	lecture, comparative study	
	4	Film thickness and its control, Substrate cleaning	3	Assess and control film thickness	PPT Illustration, Descriptive lecture	
V	**Conduction in thin films and some applications**					
	1	Conduction in continous film-formulation, Conduction in discontinuous metal film-formulation, Conduction in semiconducting film, Conduction in insulator film	4	To understand conduction in continous and discontinous film	lecture, comparative study, theoritical formulation	Evaluation through: quiz, short questions Descriptive answers Formative assessment (III)
	2	Conduction in semiconducting film, Conduction in insulator film	3	To understand conduction in semiconductingfilm	comparative study, theoritical formulation	
	3	Intrinsic semiconductor, Extrinsic semiconductor, Impurity energy level	4	Differentiate between intinsic and extrinsic semiconductors	comparative study, theoritical formulation	
	4	Technological applications.	3	Relate the different technological applications applications of thin films	PPT Illustration, Descriptive lecture	

Course instructor: Dr. Fernando Loretta **Head of the Department:** Dr. S. Mary Delphine

Semester: II

Name of the Course: Mathematical Physics

Subject code : PP1722

Teaching Plan

Unit	Modules	Topics	Lecture hours	Learning outcome	Pedagogy	Assesment/Evaluation
I	**Complex Analysis**					
	1	Analytic functions – Cauchy – Riemann equations in cartesian and polar forms– Harmonic functions - Cauchy's integral theorem – Cauchy's integral formula	4	To be able to evaluate the integrals using Cauchy's formula	Problem solving using the formula	Evaluation through: quiz, Problem solving short questions Descriptive answers Formative assessment
	2	Taylor's Series – Laurentz series	3	To be able to apply the series in computational science and approximation	Analysis and Problem solving	
	3	Cauchy's residue theorem – Singular points of an Analytic function – Evaluation of residues - application to evaluation of definite integrals	4	To evaluate line integrals of analytic functions	Analysis and Problem solving	
	4	Integration around a unit circle –Jordan's Lemma.	3	To be able to evaluate contour integrals	Analysis and Problem solving	
II	**Polynomials**					
	1	Legendre differential equation and Legendre functions – generating functions	4	To acquire basic understanding of the partial differential equations and learn some methods for solving them.	Analysis and Problem solving	Evaluation through: quiz, short questions Descriptive answers Formative assessment
	2	Rodrigue's formula – Orthogonal Properties - recurrence formula	3	To perform operations with differential equations along with the recurrence formulae	Analysis and Problem solving	
	3	Bessel differential equation – Bessel functions of I kind - recurrence formula and generating functions	4	To execute operations with Bessel differential equations	Analysis, Problem solving and comparative study	
	4	Hermite differential equations and Hermite polynomials - Generating functions & recurrence formula.	3	To carry out operations with Hermite differential equations along with the recurrence formulae	Analysis, Problem solving and comparative study	

III	**Partial Differential equations and Green's function**					
	1	Solution of Laplace equation in Cartesian coordinates- Solution of heat flow equations	4	To be able to solve boundary value problems for laplace.s equation	Analysis and Problem solving	Evaluation through: quiz, short questions Descriptive answers Assignment on applications Formative assessment
	2	Method of separation of variables – variable linear flow – One and two dimensional heat flow	4	To be able to solve problems for heat equations	Analysis and Problem solving	
	3	Green's function for one dimensional case- general proof of symmetry property of Green's function- Eigen function: expansion of Green's function-	4	To construct Green's function for one dimensional boundary value problems from fundamental solutions	Analysis and Problem solving	
	4	Green's function for Poisson equation and solution of Poisson equation. Green's function for quantum mechanical scattering problem.	2	To apply Green's function to solve problems	Analysis and Problem solving	
IV	**Tensors, Fourier and Laplace transforms**					
	1	Contravarient and Covarient tensors, Addition and subtraction, outer product, inner product of tensors		To be able to solve mathematical problems involving tensors	Analysis and Problem solving	Evaluation through: quiz, short questions Descriptive answers Assignment on applications. Formative assessment
	2	Contraction of a tensor, Symmetric and anti-symmetric tensors – The Kronecker delta	3	To be equipped to use tensor algebra as a tool in the field of applied sciences	Analysis and Problem solving	
	3	Fourier transform- properties of Fourier transform - Fourier transform of a derivative		To be familiarized with the concept of Fourier transform	Analysis and Problem solving	
	4	Laplace transform- properties of Laplace transform- Laplace transforms of the derivative of a function	4	To be able to use the Laplace transform for solving boundary value problems	Analysis and Problem solving	
V	**Group theory**					
	1	Group postulates – abelian group – Cyclic group – Group multiplication table – Rearrangement theorem, Subgroups	2	To understand the mathematics of group theory	Descriptive lecture, Analysis and Problem solving	Evaluation through: quiz, short

	2	Isomorphism and Homomorphism, Symmetry elements and symmetry operations	4	To understand the symmetry and point group of molecules	Descriptive lecture, Analysis and Problem solving	questions Descriptive answers
	3	– Reducible and irreducible representations -	3	To generate a representation and to reduce it to its irreducible representation	Descriptive lecture Analysis and Problem solving	Group discussion
	4	The great orthogonality theorem - character table for C_{2V}& C_{3V} point groups.	4	To determine the irreducibility of a reducible representation	Descriptive lecture Analysis and Problem solving	Formative assessment

Course instructor: Dr.M. Mary Freeda **Head of the Department:** Dr. S. Mary Delphine

Semester : II

Name of the Course :QUANTUM MECHANICS

Subject code : PP1723

Unit	Modules	Topics	Lecture hours	Learning outcome	Pedagogy	Assesment/Evaluation
I	**Schrodinger Equations**					
	1	Wave packet – Time dependent Schrödinger equation – Interpretation of the wave function – Time independent Schrödinger equation	4	To understand basic concepts of quantum mechanica by deriving time dependent and time independent Schrodinger equation	Illustration and theoretical derivation	Evaluation through: quiz, Problem solving short questions
	2	Stationary states – Admissibility conditions on the wave function – Eigen functions and eigen values – Hermitian operator – Postulates of quantum mechanics	2	To be able toevaluateeigen value problems	Illustration, Theoretical formulation Problem Solving	Descriptive answers
	3	Simultaneous measurability of observables – General uncertainty relation – Dirac's notation	4	To analyze observables and their properties	Analysis Theoretical formulation and Problem solving	Formative assessment
	4	Equations of motion – Momentum representation – Linear Harmonic oscillator – Operator method	4	To understand the operatormethod for solving physical problems	Theoretical formulation and Problem solving	
II	**Angular Momentum**					

	1	Angular momentum operators – Angular momentum commutation relations – Eigen values and eigen functions of L^2 and L_z	3	To understand the basic concepts and features related to Angular momentum	PPT Illustration, lecture, and Problem solving	Evaluation through: quiz, short questions Descriptive answers Problem solving Formative assessment
	2	General angular momentum – Eigen values of J^2 and J_z	3	To relate angular momentum and general angular momentum	Descriptive lecturecomparative study	
	3	Angular momentum matrices – Spin angular momentum – Spin vectors for spin-(1/2) System	3	To formulate angular momentum matrices	Theoretical formulation and Problem solving	
	4	Addition of angular momentum:Clebsch-Gordon coeffiecients – Stern Gerlach Experiment.	3	To obtain C-G coefficient from angular momentum	Illustration,Theoretical formulation and Problem solving	
III	**Approximation methods**					
	1	Time independent perturbation theory: Basic concepts – Non-degenerate energy levels – Anharmonic oscillator – First-order correction – Effect of electric field on the ground state of hydrogen.	3	To formulate time independent perturbation theory and analyze its applications	Illustration, Theoretical formulation and Problem solving	Evaluation through: quiz, short questions Descriptive answers Assignment on applications Formative assessment
	2	Variation method :Variational principle – Ground state of Helium	2	To understand variationalprinciple	Illustration,Theoretical formulationand Problem solving	
	3	WKB Approximation : WKB method – Connection formula – Barrier penetration – Alpha emission	3	To understand WKB method	Illustration, Theoretical formulation and Problem solving	
	4	Time dependent perturbation theory: First order perturbation – Harmonic perturbation – Transition to continuum states – Absorption and Emission of radiation – Einstein's A and B coefficients – Selection rules.	4	To formulate time dependent perturbation theory and analyze its applications	Illustration, Theoretical formulation comparative study and Problem solving	
IV	**Scattering theory**					

	1	Scattering cross-section – Scattering amplitude	1	To understand the basic concepts and features related to scattering	PPT Illustration, And Descriptive lecture	Evaluation through: quiz, short questions Descriptive answers Assignment on applications. Formative assessment
	2	Partial waves – Scattering by a central potential: Partial wave analysis	3	To understand the concept of partial waves	Descriptive lectureTheoretical formulation	
	3	Scattering by an attractive square-well potential – Scattering length - Expression for phase shifts - Integral equation	4	To apply scattering theory to physical problems	Descriptive lecture and Theoretical formulation	
	4	The Born approximation – Scattering by screened coulomb potential – validity of Born approximation	4	To understand Born approximation	Descriptive lecture and Theoretical formulation	
V	**Relativistic Theory**					
	1	Klein – Gordon Equation – Interpretation of the Klein-Gordon equation	3	To understand basic concepts of relativistic wave theory	Descriptive lecture and Theoretical formulation	Evaluation through: quiz, short questions Descriptive answers Problem Solving Formative assessment
	2	Particle in a Coulomb field – Dirac's equation for a free particle	3	To apply relativistic theory to Coulomb field problem	Descriptive lectureTheoretical formulation	
	3	Dirac matrices – Plane wave solution – Negative energy states – Spin of the Dirac particle	3	To analyze negative energy states using theories	Descriptive lecture Theoretical formulation	
	4	Magnetic moment of the electron – Spin-orbit interaction.	3	To apply relativistic theory to real time problem	Illustration,Theoretical formulation Problem Solving	

Course instructor: Dr. Priya Dharshini **Head of the Department:** Dr. S. Mary Delphine

Semester IV

Elective IV (a) : Nano Physics

Subject code: PP1744

Teaching Plan

Unit	Modules	Topics	Lecture Hours	Learning outcomes	Pedagogy	Assessment/valuation
I	**Nanomaterials Synthesis and Characterization**					
	1	Nano structures – Synthesis of	**4**	Identify Nano structures &	Lecture discussion	Evaluation

		nanoparticles : Sol-gel processing – Arrested precipitaiton – Biosynthesis of nanomaterials using plants		Biosynthesis of nanomaterials using plants		Class test, oral question Assignment I
	2	Carbon nanotubes - Electronic structure of carbon nanotubes - Types of carbon nanotubes	**3**	Apply various Electronic structure of carbon nanotubes	Derivation and group discussion	
	3	Synthesis of carbon nanotubes: Laser method- CVD (Pyrolysis of Hydrocarbons) – CVD method on flat surfaces - Solar production of carbon nanotubes – Properties - Applications	**4**	Discuss various methods of synthesis of carbon nanotubes	Derivation, and group discussion	
	4	Fullerene – Properties of Fullerene. Structural characterisation: XRD – Scanning Tunnelling Microscope (STM) – Atomic Force Microscope (AFM) – Properties of nanomaterials. Structural characterisation: XRD – FTIR	**4**	Apply Fullerene. Structural characterisation	Derivation and group discussion seminar	
II	Quantum hetrostructures					
	1	Novel phenomena - Heterostructure – Growth of heterostructure – Molecular Beam Epitaxy	**4**	Explain the in nanostructures for different dimensions	Derivation discussion	Evaluation Class test, oral question Assignment I/II
	2	Band alignment – Quantum well – Superlattice - Doped Heterostructures – Quantum wells in heterostructures	**3**	Define and derive Superlattice & Doped Heterostructures	Derivation and group discussion seminar	
	3	Effective mass theory	**4**	Statement and	Derivation	

		in heterostructures – Application of effective mass theory in quantum wells in heterostructures		proof of Effective mass theory	and group discussion problem solving	
	4	Applications of heterostructures.	**4**	Heterostructures and its applications	Derivation and group discussion	
III	**Quantum well, quantum wires & quantum dots**					
	1	Preparation of Quantum nanostructures - Size effects - Fermi gas and density of states - Calculation of the density of states	**4**	Analyse Quantum nanostructures	Derivation discussion	Evaluation Class test, oral question Assignment II
	2	Quantum wire – Production, structure and uses – Quantum dot : production	**2**	Define and derive Production, structure and uses of Quantum nanostructures	Derivation and group discussion seminar	
	3	Epitaxially self assembled quantum dots – Electronic energy states – Application	**5**	Define and Derive Electronic energy states	Derivation and group discussion,PPT	
	4	Quantum well infrared detector – Quantum well and quantum cascade laser – Quantum dot laser.	**4**	Define, derive and apply Quantum well and quantum cascade laser &Quantum dot laser.	Lecture and group discussion PPT	
IV	**Magneto electronics and applications of nanotechnology**					
	1	Nano crystalline soft magnetic materials – Permanent magnet materials – Preparation of magnetic nanomaterials	**4**	Discuss different types of Nano crystalline soft magnetic materials	Derivation discussion	Evaluation Class test, oral question Assignment II/III
	2	Super paramagnetism - Coulomb blockade – Single electron	**4**	Define and derive Coulomb blockade and its	Derivation and group discussion,	

		transistor - Spintronics		applications	PPT	
	3	Giant magnetoresistance - Quantum Hall effect - Quantum spin Hall effect	**3**	Define and Derive different types of Giant magnetoresistance	Derivation and group discussion seminar	
	4	Fractional quantum Hall effect - Applications of nanotechnology.	**4**	Applications of nanotechnology	Lecture and group discussion PPT	
V	**Applications of Nanomaterials**					
	1	Nanoelectronics – Introduction – Sensors – MEMS/NEMS	**4**	Analyse Fundamental Nano Sensors	Discussion PPT	Evaluation Class test, oral question Assignment **III**
	2	Solar cells – Displays – Optical switches	**4**	Analyse classification Solar cells	group discussion, PPT	
	3	Graphene electronics – Biosensors – Biomarkers and Bioimaging	**3**	Explain Graphene electronics	Derivation and group discussion seminar	
	4	Targeted drug delivery – Nanorobots.	**4**	Define , derive and apply Nanorobots	Derivation and group discussion, PPT	

Course instructor: Dr. C. Nirmala Louis **Head of the Department:** Dr. S. Mary Delphine

Semester IV
Material Science
Subject Code: PP1741

Teaching Plan

Unit	Modules	Topics	Lecture hours	Learning outcome	Pedagogy	Assesment/Evaluation
I	**Phase diagram**					
	1	Phase rule- Single component systems	2	To understand basic concepts of phases of materials.	Illustration and theoretical explanation	Evaluation through: quiz,
	2	Binary Phase diagrams- Microstructural Changes during Cooling	2	To understand the microstructural changes of materials.	Illustration, Theoretical explanation	Problem solving
	3	The lever rule- Applications of phase diagrams- Phase transformations- Time scale for phase changes	4	To analyze phase transformations.	Analysis and Theoretical explanation	short questions

	4	The growth and the overall transformation kinetics of nucleation– Applications	4	To understand the process of nucleation.	Theoretical explanation and Problem solving	Descriptive answers Formative assessment
II	**Elastic Behaviour**					
	1	Atomic model of elastic behavior	3	To understand the basic concepts of elastic behavior.	PPT Illustration, Lecture.	Evaluation through: quiz, short questions Descriptive answers Problem solving Formative assessment
	2	The modulus as a parameter in Design	3	To understand the importance of elasticity in designing structures.	Descriptive lecture, comparative study.	
	3	Rubber-like elasticity-Anelastic behavior:	3	To understand anelastic behavior.	Theoretical explanation	
	4	Relaxation Processes- Viscoelastic behavior: Spring-Dashpot models	3	To analyze relaxation processes in materials.	Illustration, Theoretical explanation	
III	**Imperfections**					
	1	Crystal imperfections- Point imperfections	4	To interpret crystal imperfections.	Illustration, Theoretical explanation	Evaluation through: quiz, short questions Descriptive answers Assignment on applications Formative assessment
	2	The geometry of dislocations- other properties of dislocations	4	To understand properties of dislocations	Illustration, Theoretical explanation	
	3	surface imperfections	4	To analyze surface imperfections	Illustration, Theoretical explanation, comparative study	
IV	**Oxidation, Corrosion and other deformation of materials**					
	1	Mechanisms of oxidation-oxidation	1	To understand the basic concepts and	PPT Illustration,	Evaluation through: quiz,

		resistant materials		features of oxidation resistant materials.	And Descriptive lecture	short questions
	2	the principles of corrosion-protection against corrosion	3	To understand the concept of corrosion.	Descriptive lecture, Theoretical explanation	Descriptive answers
	3	plastic deformation- the tensile stress- stress-strain curve- plastic deformation by slip creep	4	To apply deformation theory to analyze the tensile stress and plastic deformation.	Descriptive lecture and Theoretical explanation	Assignment on applications.
	4	mechanisms of creep-creep resistant materials- Ductile fracture- Brittle fracture- Methods of protection against fracture.	4	To understand methods of protection against fracture	Descriptive lecture and Theoretical explanation	Formative assessment

Course instructor: Ms. M. Abila Jeba Queen **Head of the Department:** Dr. S. Mary Delphine

Semester IV
Molecular Spectroscopy
Subject Code: PP1743

Teaching Plan

Unit	Modules	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I	**Microwave spectroscopy**					
	1	Classification of molecules - Interaction of radiation with rotating molecule	**3**	To understand the classification of molecules and their interactions.	Lecture Discussion with PPT illustration	Evaluation through short test Multiple choice questions Assignment Seminar Formative assessment I
	2	Rotational spectra of rigid diatomic molecules – Isotope effects in rotational spectra – Intensity of rotational lines	**4**	To acquire knowledge on the rotational spectra of rigid diatomic molecules	Lecture videos PPT	
	3	Non-rigid rotator – Vibrational excitation effects – Symmetric top molecules	**3**	To know the principles of Non-rigid rotator and Symmetric top molecules	Lecture discussion	
	4	Microwave spectrometer –	**3**	To identify the	PPT	

		Information derived from rotational spectra.		principles and working of microwave spectrometer	Illustration , Descriptive lecture	
II	**Infrared spectroscopy**					
	1	Vibrational energy of a diatomic molecule – Infrared spectra – Infrared selection rules	**4**	To understand infrared spectra and acquire knowledge on selection rules	Lecture Illustration videos PPT	Short test Quiz Assignment Formative assessment I
	2	Vibrating diatomic molecule – Diatomic vibrating rotator – Asymmetry of rotation	**4**	To acquire knowledge on diatomic vibrating rotator and asymmetry of rotation.	Lecture discussion videos PPT	
	3	Vibration band – Vibrations of polyatomic molecules – Rotation vibration spectra of polyatomic molecules	**4**	To derive equations for rotation-vibration spectra of polyatomic molecules.	Lecture discussion videos PPT	
	4	IR spectrophotometer – Instrumentation - Sample handling techniques – Fourier transform infrared spectroscopy – Applications (any two)	**2**	To understand the working of IR spectrophotometer and discuss its applications.	Lecture Illustration videos PPT	
III	**Raman spectroscopy**					
	1	Theory of Raman scattering – Rotational Raman spectra	**5**	To acquire knowledge on Raman scattering	Lecture with PPT Illustration	Assignment Seminar Formative assessment

	2	Vibrational Raman spectra – Mutual exclusion principle	**3**	To understand the concept of vibrational Raman spectra and Mutual exclusion principle	Question-answer session Lecture	II
	3	Raman spectrometer – Polarization of Raman scattered light - Structure determination using IR and Raman spectroscopy.	**5**	To understand the working of Raman spectrometer and differentiate IR and Raman spectroscopy.	Lecture with PPT Illustration	
IV	**Electronic spectroscopy**					
	1	Introduction – Vibrational coarse structure – Vibrational analysis of band systems	**3**	To understand the concept of vibrational analysis of band systems	Lecture Discussion videos ppt	Formative assessment II
	2	Progressions and sequences – Information derived from vibrational analysis	**3**	To distinguish progressions and sequences	Lecture Discussion videos	
	3	Frank – Condon principle – Intensity of vibrational electronic spectra	**4**	To have a knowledge on Frank Condon principle and intensity of vibrational spectra.	Lecture with PPT Illustration	

Course instructor: Dr. Theresiamma Chacko **Head of the Department:** Dr. S. Mary Delphine