Course Structure

of

Physics Department

M.Sc (Physics)

(w.e.f. 2020-21 as per CBCS)

[DEPARTMENT OF PHYSICS]

[Institute of Applied Sciences & Humanities]

Course Structure of M.Sc (Physics) I Year

SEMESTER – I

S.No.	Course	Title	Credits	Remark
1.	MPHS0001	Mathematical Physics	4	New courses
2.	MPHS0002	Classical Mechanics and Relativity	4	
3.	MPHS0003	Statistical Mechanics	4	
4.	MPHS0004	Quantum Mechanics – I	4	
5.	MPHS0801	General Physics Lab. -1	6	
	Total		22	

SEMESTER – II

S.No.	Course	Title	Credits	Remark
1.	MPHS0005	Electronics-I	4	New courses
2.	MPHS0006	Quantum Mechanics – II	4	
3.	MPHS0007	Nuclear Physics	4	
4.	MPHS0008	Solid State Physics	4	
5.	MPHS0802	General Physics Lab. -2	6	
	Total		22	

Course Structure of M.Sc (Physics) II Year

SEMESTER – III

S.No.	Course	Title	Credits	Remark
1.	MPHO0009	Introduction to Linear and digital integrated circuits-I (Elective-I)	4	New courses
2.	MPHS0010	Electronics-II	4	
3.	MPHS0011	Classical Electrodynamics	4	
4.	MPHS0012	Computational Physics and Programming	4	
5.	MPHS0803	Electronics Lab-1	6	
	Total		22	

SEMESTER – IV

S.No.	Course	Title	Credits	Remark
1.	MPHS0013	Atomic and Molecular Physics	4	
2.	MPHO0014	Introduction to Linear and digital integrated circuits-II (Elective - II)	4	
3.	MPHS0950	Dissertation	10	New Course
4.	MPHS0804	Electronics Lab-2	6	
	Total		24	

SUMMARY OF COURSE STRUCTURE

S.No.	Semester	No. of Paper		No. of Pratical		Total
		Theory	Credits	Practical/week	Credits	
1.	I	4	16	4 (12 hours/week)	6	22
2.	II	4	16	4 (12 hours/week)	6	22
3.	III	4	16	4 (12 hours/week)	6	22
4.	IV	8+10 Dissertation	18	4 (12 hours/week)	6	24
						90 credits

DETAILED SYLLABUS

COURSE SYLLABUS

MPHS0001: MATHEMATICAL PHYSICS

Credits: 04 **SEMESTER : I** **L – T – P**

4 0 0

Module No.	Content	Teaching Hours (Approx.)
I	**Legendre's Differential equation:** The Power seriese quation: Solution–Legendre Functions of thefirst and second kind –Generating Function-Rodrigues'– Orthogonal Formula Properties – Recurrence Relations. Beta and Gamma function – Properties –Relations between them. **Bessel's Differential Equation:** Power series Solution equation–Bessel Functions of First and Second kind- Generating Function –Orthogonal Properties –Recurrence Relations.	24
II	**Hermite Differential Equation :** Power series Solution–Hermite polynomials – Generating Function-Orthogonality –Recurrence relations -Rodrigues formula, **Languerre function.** **Fourier Transform :** Infinite Fourier Sine and Cosine transforms–Properties of Fourier transforms-Derivative of Fourier transform –Fourier transform of a derivative Fourier Sine and Cosine transform of derivatives-Finite Fourier transforms – Applications of Fourier Transforms. **Laplace Transform:** Properties of Laplace transforms –Derivative of Laplace transform– Laplace transform of a derivative –Laplace transform of periodic functions	24

Reference Books/ Text Books / Cases:

1. Applied Mathematics for Engineers and Physicists –Lious A Pipes and Lawrance R. Rarvill.
2. Mathematical Physics –AK Ghatak, IC Goyal and SL Chua-Macmillan India Ltd.
3. Vector and Tensor Analysis –Scham Series. 4. Mathematical Physics –SatyaPrakash

COURSE SYLLABUS

MPHS0002: CLASSICAL MECHANICS AND RELATIVITY

Credits: 04 **SEMESTER : I** **L – T – P**

4 0 0

Module No.	Content	Teaching Hours (Approx.)
I	**Lagrangian formalism :** Constraints, generalized coordinates. Principle Lagrange's equations from-Applications D'Alembert's of principle, Lagrangian (plane and spherical pendulums, L-C circuit), velocity dependent potential-Lagrangian for a charged particle in electromagnetic field, Euler Hamilton's-Lagrangian principle equation's from Hamilton's principle. **Hamiltonian formalism-I:** Principle of Least Action–Application sand Hamilton's of Hamiltonian equation of (motion of a particle in a central force field, projectile motion of a body).	24
II	**Hamiltonian formalism-II:** Cyclic coordinates and conservation theories, Canonical coordinates and canonical transforms, Conditions for a transformation to be canonical, generating functions, Lagrange and Poisson brackets. Hamilton equations in Poisson bracket from, Hamilton Jacobi theory. **Mechanics of continuous systems :** Analysis of the free vibrations of a linear triatomic molecule, Eigen value equation- Principal axis transformation-Frequencies and normal coordinates Lagrangian formulation for continuous systems, Hamiltonian formulation.	24

Reference Books/ Text Books / Cases:

1. Classical Mechanics : By Goldstein, Poole & Safko (Pearson 2002)
2. Classical Mechanics :By JC Upadhyaya (Himalaya Publishing House)
3. Classical Mechanics : H.M. Agrawal (New Age Publication 2017)
4. Classical Mechanics :Rana & Joag (TMH)
5. Classical Mechanics of Particles and Rigid Bodies :Kiran C Gupta. (New Age International Publishers)
6. Lagrangian and Hamiltonian Mechanics: Calkin (Allied Publishers 2000)
7. Lagrangian Dynamics : Dave Wells (schaum series 19)

COURSE SYLLABUS

MPHS0003: STATISTICAL MECHANICS

Credits: 04 **SEMESTER : I** **L – T – P**

4 0 0

Module No.	Content	Teaching Hours (Approx.)
I	**Relation between thermodynamics and statistical mechanics:** Micro stages and macro states of a system – Phase space- Ensembles – Mean values and ensemble average – Density distribution in phase space- Liouville's theorem. Apriori probability postulate – Micro canonical, canonical and grand canonical ensembles –Quantization of phase space. Entropy and Probability –Equilibrium conditions: Thermal, mechanical and concentration equilibrium. Entropy of a perfect gas using micro canonical ensemble-Gibbs paradox. **Maxwell –Boltzmann statistics-I:**D istribution law- Maxwell velocity distribution-Equi-partition theorem. Canonical ensemble- Partition function-Ideal gas, Grand canonical ensemble Partition function-Ideal gas. Quantum Statistical Mechanics.	24
II	**Maxwell –Boltzmann statistics-II :** Postulates Indistinguishability-Bose-Einstein and Fermi-Dirac statistics and distribution laws. Partition function and thermodynamic quantities-Translational, rotational and vibrational partition functions - Specific heat of diatomic molecules. **Ideal Bose**: Einstein gas-Energy and pressure of the gas. Bose-Einstein condensation Liquid Helium-Two Fluid model-Phonons, protons, super fluidity. Ideal Fermi-Dirac gas Energy and pressure of the gas –Electronic specific heat, thermionic emission, white dwarfs	24

Reference Books/ Text Books / Cases:

1. Statistical Mechanics by SatyaPrakash and JP Agarwal (Pragati Prakahan-2002)
2. Statistical Mechanics by Gupta and Kumar (PragathiPrakahan -2002)
3. Statistical Mechanics by BK Agarwal and M Eisner (New Age Internaional)
4. Statistical Mechanics by RK Srivatava and J Ashok (Prentice Hall, India)
5. Introduction to phase transitions and critical Phenomena HE Stanley (Clrendon Press, Oxford).
6. Heat and Thermodynamics by Zemansky (TMH).

COURSE SYLLABUS

MPHS0004: QUANTUM MECHANICS- I

Credits: 04 **SEMESTER : I** **L – T – P**

4 0 0

Module No.	Content	Teaching Hours (Approx.)
I	**Development of Old Quantum Theory:** Wilson- Somerfield Quantization rule, shortcommings of old quantum theory, dual nature of light and matter, phase and group velocity, equation of motion of matter waves,: Schrodinger's equation, physical interpretation to wave function, normalized and orthogonal wave function, expectation values of dynamical quantities, probability currect density ; particle flux, ehrensfest's theorem, mathematical proof of uncertainty principle, gaussiam wave packets, application of Schrodinger's equation; particle in a box, potential step, rectangular potential barrier (α - decay). Three dimensional harmonic oscillator.	24
II	**Spherically Symmetric System:** Three dimensional harmonic oscillator (Spherically Symmetric case), The Hydrogen atom, degeneracy, normal state of hydrogen atom, Operator and liner operator, eigen values and eigen function, the operator formalism in quantum mechanics, momentum operator, Hamiltonian operator, Hermitian operators and properties, the parity operators, commutation algebra, hygine berg uncertainty relation derived from operators, identical particles, symmetric and anti-symmetric wave function, pauli spin mates for electrons, commutation relation , density operator and density metrics	24

Reference Books/ Text Books / Cases:

1. Advanced Quantum Mechanics by Satya Prakash
2. A Text book Quantum Mechanics : PM Mathews and K Venkateshan (TMH)
3. Quantum Mechanics by Ghatak and Lokanathan (Macmillian)
4. Quantum Mechanics by E Merzbacher (John Wiley)

COURSE SYLLABUS

MPHS0005: ELECTRONICS-I

Credits: 04 **SEMESTER : II** **L – T – P**

4 0 0

Module No.	Content	Teaching Hours (Approx.)
I	**Regulated Power Supply:** Principle of Zener regulator, Transistorized Series regulator, Regulated power supplies using IC 723. Switch Mode Power Supply (SMPS). **Transistors**: BJT, JFET and MOSFET: working, configurations, characteristics, application as small signal amplifier. Hybrid parameters (h parameters), Hybrid π- model at small signal. High frequency model using hybrid πmodel. **Amplifiers**: Feedback in amplifiers and advantages of Negative feedback in amplifiers. Cascading in amplifiers. RC coupled amplifiers, Emitter follower, Differential amplifier and Darlington pair.	24
II	**Sinusoidal Oscillators**: Criterion of feedback oscillator and negative resistance oscillator, Phase shift Oscillator, Wein Bridge Oscillator, Crystal Oscillator. **Operational Amplifiers:** Characteristics of Ideal operational Amplifier, Block diagram of an IC operational Amplifier, Analysis of inverting and Non-inverting amplifier. Applications- Integrator, Differentiator, summing amplifier, Difference amplifier, Comparator, Logarithmic amplifier and exponential amplifier. **Waveform generator / Multivibrator :** Timer IC 555: Working and operating modes. Square wave, Rectangular wave, Triangular wave and Sine wave generation using IC555. Schmitt trigger.	24

Reference Books/ Text Books / Cases:

1. Integrated Electronics –Milman Halkies.
2. Microelectronics –Milliman & Grabel.
3. Digital principles and applications- Malvino and Leech
4. Operational amplifier –Gawkward
5. Fundamentals of electronics by JD Ryder, Wiely.
6. Electronic Devices and Circuit theory, R.L. Boylestad and L. Nashelsky, Prentice Hall

COURSE SYLLABUS

MPHS0006 : QUANTUM MECHANICS- II

Credits: 04 **SEMESTER : II** **L – T – P**

4 0 0

Module No.	Content	Teaching Hours (Approx.)
I	**Angular Momenta and their properties:** Angular Momenta operator in position representation, total Angular Momentum operators, Communication Rules, Eigen values of J^2 and J^z.. Eigen functions of J^y J^z Addition of Angular Momenta,: Clebsch – gordan coefficient **Time Dependent Perturbation Theory:** Time Independent Theory, Stationery perturbation theory (non-degenerate case), physical application of non-degenerate perturbation theory: normal helium atom, perturbed harmonic oscillator, zeeman effect, stationery perturbation theory : degenerate case, stark effect, variation method, ground state of hydrogen atom, The WKB Method.	24
II	**Relativistic Quantum Mechanics:** Klein –Gordon Equation, Plane wave solution and Equation of continuity, Probability density- Dirac Equation, alpha, beta- matrices, Plane wave solution, significance of negative energy states. Spin of Dirac particle Relativistic particle in central potential, Dirac Equation for central field force and its solution. **Quantization of Fields (II Quantization) :** The classical approach to field theory, relativistic lagrangian and Hamiltonian of a charged particle in electromagnetic field, quantum equation for the field , II quantization, quantization of non-relativistic Schrodinger equation, creation, annihilation and number operators , quantization of Klein –Gordon Equation.	24

Reference Books/ Text Books / Cases:

1. Advanced Quantum Mechanics by Satya Prakash
2. A Text book Quantum Mechanics : PM Mathews and K Venkateshan (TMH)
3. Quantum Mechanics by Ghatak and Lokanathan (Macmillian)
4. Quantum Mechanics by E Merzbacher (John Wiley)

COURSE SYLLABUS

MPHS0007 : NUCLEAR PHYSICS

Credits: 04 **SEMESTER : II** **L – T – P**

4 0 0

Module No.	Content	Teaching Hours (Approx.)
I	**Nuclear and Particle Physics:** Basic nuclear properties; size, shape and charge distribution, spin and parity. Binding energy, semi empirical mass formula, liquid drop model. Nature of nuclear force, form of nuclean-nuclean potential, charge-independence and charge-symmetry of nuclear forces, deuteron problem. Evidence of shell structure, single-particle shell model, its validity and limitation. Rotational spectra. **Nuclear Decay:** Fermi theory of beta-decay, Curie plots, Comparative half life, Allowed and forbidden transitions, Detection and properties of neutrino, Electromagnetic interactions in nuclei, Multipole transitions in nuclei, Parity and angular momentum selection rules, Internal conversion.	24
II	**Nuclear Reactions:** Discussion of Direct and Compound nuclear reaction mechanisms, expressions for scattering and reaction cross sections in terms of partial wave amplitudes, Resonances, Discussions and Applications of Breit-Wigner single level formula, compound nucleus theory. **Detectors and Accelerators:** Outline of interaction of charged particles and of Gamma-rays with matter. Detectors: Gas Filled counters (ionization Chamber), Scintillation counter, Spark Chambers, Cerenkov detectors. Accelerators: Ion Sources, Synchrotron, Introduction of Modern Colliders (LHC and RHIC), Storage Ring. **Particle Physics:** Basic interactions in nature, Elementary particles, Quantum numbers and conservation laws, Concept of isospin, Quarks and colors, Quark model, Eightfold way, Mesons and Baryons, Bound states and resonance states.	24

Reference Books/ Text Books / Cases:

1. Atomic and Nuclear Physics Vol. II: Ghoshal.
2. Nuclear Structure: Preston and Bhaduri.
3. Nuclear Physics (Problem oriented approach) : PHI(2016), Hari M.Agrawal
4. Introductory Nuclear Physics: Wong.
5. Nuclear Theory: Elton.
6. Nuclear Interactions: de Benedetti.

COURSE SYLLABUS

MPHS0008 : SOLID STATE PHYSICS

Credits: 04 **SEMESTER : II** **L – T – P**

4 0 0

Module No.	Content	Teaching Hours (Approx.)
I	**Crystalline State & Structural Studies :** Crystal translational vectors, unit cell, Bravais lattices, Crystal system, Miller indices, Symmetry operations, Point groups, Space groups and their notation. Crystal structures of fcc, bcc, hcp, CsCl, NaCl, ZnS and Diamond. Bragg's law, Atomic structure factor, Geometrical structure factor and Debye Wallar factor, Concept of reciprocal lattice, Concept of Brillouin zones, Experimental methods of X-ray diffraction of crystals – Laue and Powder methods, Determination of unit cell parameters of a cubic crystal, Elements of neutron and electron diffraction. **Lattice Vibrations and Thermal Properties-I:** Elastic waves in one dimensional array of identical atoms, Vibrational modes of a diatomic linear lattice and dispersion relations, Acoustic and Optical modes, Infrared absorption in ionic crystals,	24
II	**Lattice Vibrations and Thermal Properties-II:** Phonons and verification of dispersion relation in crystal lattices. Lattice heat capacity- Einstein and Debye theories, Lattice thermal conductivity –Phonon mean free path, Origin of thermal expansion and Grunceisen relation. **Band Theory and Semiconductor Physics :** Failure of Free electron theory of metals, Bloch theorem, Behavior of electron in periodic potentials, Kronig-Penny model, E vs K relation, Density of states in a band, Effective mass of electron, Negative effective mass and concept of hole. Distinction between metals, Semiconductors and Insulators, Intrinsic semiconductors, Fermi level, Expressions for electron and hole concentrations in intrinsic and extrinsic semiconductors, Hall effect in semiconductors. Classification of imperfections, Schottky and Frenkel defects. DislocationsEdge and Screw dislocations, Dislocation multiplication, Grain boundaries.	24

Reference Books/ Text Books / Cases:

1. Crystallography and Solid State Physics – A.R. Verma and O.N. Srivastava
2. Solid State Physics – A.J. Deckker, Macmillian Indian Ltd, 2003.
3. Introduction to Solid State Physics – C. Kittel, Johan Wiley Sons Inc, New York
4. Solid State Physics- RL Singhal, KedarNath&Ramnath& Co, 2006
5. Elements of Solid State Physics – J.P. Srivastava, Prentice Hall India, 2006.
6. Elements of Solid State Physics -- Ali Omar, Pearson Education Inc, 2002.

MPHO0009: INTRODUCTION TO LINEAR AND DIGITAL INTEGRATED CIRCUITS-I (ELECTIVE-I)

Credits: 04 **SEMESTER : III** **L – T – P**

4 0 0

Module No.	Content **Digital Logic Circuits and Applications**	Teaching Hours (Approx.)
I	Cathode Ray Oscilloscope: Block Diagram of CRO. Applications of Oscilloscope: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency and Phase Difference. Number System and Logic Gates: Analog and Digital Circuits. Binary Numbers. Binary Number System, Decimal to Binary and Binary to Decimal Conversion. Octal and Hexadecimal Numbers. AND, OR, NOT, NAND and NOR Gates (realization using DL and TTL). XOR and XNOR Gates and their applications. Boolean Algebra: Boolean Laws and De Morgan's Theorems. Logic Simplification and Gate Minimization. Idea of Minterms and Maxterms. Conversion of Truth table into Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map. Binary Addition and Binary Subtraction using 2's Complement Method. Arithmetic Digital Circuits: Half Adders and Full Adders and Subtractors, 4-Bit Binary Adder-Subtractor. Data Selecting Circuits: Decoders, Encoders, Multiplexers, De-multiplexers.	24
II	Logic Sequential Circuits: Noise, Fan-out, Fan-in, Power and Speed. Flip Flops: Latch (NOR and NAND), R-S, D and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops. Master – Slave Flip Flop. Preset and Clear. Binary Counters: Asynchronous counters, Synchronous Counter, Decade Counter. Shift registers: Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers. Timers (IC 555): Block Diagram, Astable and Monostable Mode Applications. Phase Locked Loops (IC - 565): Block Diagram and Applications.	24

Reference Books/ Text Books / Cases:

1. Operational Amplifiers and Linear Integrated Circuits 6th edition, Robert F, Coughlin, Frederick F. Driscoll, Pearson Education, Asia India.
2. Design with Operational Amplifiers and Analog Integrated Circuits 2nd edition Sergio. Franco, McGraw-Hill NY USA

COURSE SYLLABUS

MPHS0010 : ELECTRONICS-II

Credits: 04 **SEMESTER : IV** **L – T – P**

4 0 0

Module No.	Content	Teaching Hours (Approx.)
I	**Analog Modulation:** Concept of Amplitude modulation, envelop DSB, SSB modulation, Frequency and phase modulation, narrow and wide band FM, reactance modulator, reactance modulator stability—AFC, indirect method – Armstrong system, balanced slope FM detection, principles of phase discriminators. Fourier Transform. **Digital Modulation:** Sampling theorem, channel bandwidth for PAM signal, natural and flat top sampling, signal recovery through holding, quantization of the signal, quantization error, pulse code modulation, differential PCM, delta modulation, adaptive delta modulation.	24
II	**Filter:** Types of filter, characteristics of filters, filtering for noise reduction, shielding and grounding. **Opto electronics Devices**: LED, Photo diode, Photo transistor, Solar Cell, LASER Diode. **Measurement & Instrumentation:** Linear and non-linear curve fittings Chi-square test, Static and dynamic characteristic of transducers, measure displacement, temperature, pressure, mass, and fluid flow using transducers. signal conditioning and recovery, amplification, sensors and actuators. Lock in detector, box-car integrator	24

Reference Books/ Text Books / Cases:

1. Taub, H and Schilling, DL : Principles of Communication Systems (Tata McGraw Hill)
2. Young, P.H. : Electronics Communication Techniques
3. Tomasi, W. : Electronic Communication Systems
4. Kennedy, G. : Electronic Communication Systems

COURSE SYLLABUS

MPHS0011: CLASSICAL ELECTRODYNAMICS

Credits: 04 **SEMESTER : III** **L – T – P**

4 0 0

Module No.	Content	Teaching Hours (Approx.)
I	**Electro-Static Potentials and Maxwell's Equations:** Special techniques for calculating electrostatic potential : Green function, Electrical image and Poisson's and Laplace's equations methods, Solutions of Laplace's equation in Cartesian, spherical and cylindrical coordinates, Application of these methods to some potential problems, Multipole expansion of potential, scalar and magnetics vector potentials. Maxwell's equations, general wave equation, Gauge transformations-Lorentz and Coulomb gauges. **Interaction of Electromagnetic Waves with Matter :** Boundary conditions for the Electromagnetic field vector at interface of two media, Reflection and Refraction of plane Electromagnetic waves at Fresnel's relations, Reflection and Transmission coefficients, Brewester's angle, Total internal reflection, Dispersion in non-conductors, Basics concepts of waveguide, Propagahon of EM Waves between two plane conducting waves and in rectangular waveguide.	24
II	**Electromagnetic Fields due to moving charges:** Inhomogeneous wave equation band its solution for returned and lienard – wiechert potentials, Electromagnetic field due to uniformly and arbitrarily moving charges, Radiation produced by law velocity and arbitrarily accelerated charges, Bremsstraling synchrotron and cerentron radiation. **Radiation Fields:** Electric and Magnetic fields due to oscillating dipole and power radiated by it, Radiation due to small current element, fields due to half wave antenna and its power distribution, antenna array.	24

Reference Books/ Text Books / Cases:

1. Classical Electrodynamics by SP Puri, Tata McGraw-Hill Publishing Co., Ltd (2000).
2. Introduction to Electrodynamics by DJ Griffiths, Prentice- Hall of India (1998).
3. Electricity and Magnetism by MH Nayfeh and MK Brussel, John Wiley and Sons (1985).
4. Classical Electrodynamics by JD Jackson, John Wiley and Sons (1999).
5. Foundations of Electromagnetic Theory by JR Rietz, FJ Milford and Christy, Narosa Publishing house (1986)
6. Engineering Electromagnetic by WH Hayt and JA Buck Tata Mc-Graw Hill (2001)
7. Electromagnetic waves and Radiating systems by EC Jordan and KG Balmain, Prentic Hall (1968)

COURSE SYLLABUS

MPHS0012 : COMPUTATIONAL PHYSICS AND PROGRAMMING

Credits: 04 **SEMESTER : III** **L – T – P**

3 1 0

Module No.	Content	Teaching Hours (Approx.)
I	Introduction to multiprogramming and time-sharing computers. Introduction to operating system. Login, creation of file and some important commands. Editor(s) and editing commands. Introduction to structured programming languages with reference to FORTRAN 77.	24
II	Constants and variables: Complex, double precision, logical and character. Arithmetic expressions, Arrays. Control statements : GO TO, Compute GO TO, IF, nested IF, Arithmetic IF, DO, Subscripted variables. Functions and Subroutines: Subprograms, Dimension Statement. Simple input/output statements. Elementary programming related to simple problems.	24

Reference Books/ Text Books / Cases:

1. Introduction to programming & Language in FORTRAN 77 , V. Rajaraman.
2. Computer Programming in FORTRAN 77, V. Rajaraman.

COURSE SYLLABUS

MPHS0013 : ATOMIC AND MOLECULAR PHYSICS

Credits: 04 **SEMESTER : IV** **L – T – P**

4 0 0

Module No.	Content	Teaching Hours (Approx.)
I	**Atomic Physics:** Dipole selection rules (examples with derivation), Natural and Doppler Broadening, Spin-orbit coupling, Lamb shift and Retherford experiment, Hyperfine structure of lines, Normal and specific mass shifts, Anomalous Zeeman effect, Paschen-Back and Stark Effects, Applications of Resonance Spectroscopy: ESR and NMR .	24
II	**Molecular Physics:** Rotational spectra of diatomic molecule as a rigid and non rigid rotator. Vibrational spectra of a diatomic molecule as a harmonic and anharmonic oscillator. A brief discussion of formation and derivation of molecular states . Vibrational structure of electronic transition: progression, sequence. Deslandre table. The Franck Condon principle .Dissociation energy. A brief discussion of Intensity alternation and missing lines in rotational spectra. Raman effect and vibrational and rotational Raman spectra of diatomic molecules.	24

Reference Books/ Text Books / Cases:

1. Physics of Atoms and Molecules: B.H. Bransden and C.J. Joachain.
2. Introduction to Atomic Spectra: H.E. White.
3. Introduction to Atomic Spectra: H.G. Kuhn.

COURSE SYLLABUS

MPHO0014: INTRODUCTION TO LINEAR AND DIGITAL INTEGRATED CIRCUITS-I (ELECTIVE-II)

Credits: 04 **SEMESTER : IV** **L – T – P**

4 0 0

Module No.	Content **Introduction to Microprocessors Architecture, Programming and Interfacing**	Teaching Hours (Approx.)
I	**Computer Organization:** Components, CPU or Microprocessor, Input Output Devices, Memory, Microprocessors. Computer Languages: Machine, Assembly and High Level Languages. **The 8085 Architecture and Microcomputer System:** The 8085 Architecture and its Operations, Block Diagram, PIN Diagram, ALU (Arithmetic Logical Unit), System Bus, Registers, Memory, Stack Memory, Control Unit, Logic Devices for Interfacing, Microprocessor System based Applications. **Introduction to 8085 Programming:** Basics of Assembly Language Programming, Instruction Format, Addressing Modes and Instructions: Data Transfer Operations, Arithmetic Operations, Logic Operations, Branch Operations, Programming Techniques like Looping and Counting.	24
II	**Concepts of Memory and Interrupts:** Types of Memory, Memory Mapping, Secondary and Cache Memory and 8085 Interrupts. **Timing and Control Circuitry:** Timing States, Control Operations, Instruction Cycle, Timing Diagram of Instructions: MOV and MVI. **Interfacing and Programmable Peripheral Devices:** In/Out Instructions, Control Word Register, Status Register, Basic Peripheral Devices, Transducers, A/D and D/A Converters, 8255 Programmable Peripheral Interface, Data Acquisition and Storage, Interfacing Keyboard and Seven Squeal Display.	24

Reference Books/ Text Books / Cases:

1. Microprocessor, Architecture, Programming and Application: R. S. Goonkar
2. Fundamental of Microprocessors and Microcontrollers: B. Ram
3. Introduction to Microprocessor: A. P. Mathur
4. Microprocessor and Interfacing: D. V. Hall