HAJEE KARUTHA ROWTHER HOWDIA COLLEGE (AUTONOMOUS)

UTHAMAPALAYAM

Choice Based Credit System

M.Sc., Physics (Semester)

Course Scheme, Scheme of Examinations and Syllabus

(Effective from the academic year 2018– 2019)

Qualification : B.Sc., as the Major subject with Mathematics & Chemistry Ancillary.

Duration of the Course : M.Sc.,-**Physics** - Two years (4 – Semesters).

Medium of Instruction: English.

Objectives of the course :

To enable the students.

1. To acquire knowledge of physics.
2. To understand the usage of physics in applied sectors.
3. To develop skills through Practicals in laboratories, lab visits in research institution and field visits in industries.
4. To become motivated for pursuing higher education & research.
5. To become skilled either to suit with employment opportunities or to make self employments

Subjects of study :

Part - III i) Core Subjects – Physics
Part - IV i) Non-major subjects

Structure of the question papers:

Theory:

Internal - 25 marks
External - 75 marks
Total - 100 marks

Question Paper:

Three Parts A, B and C (external)
Section - A - 10 questions (multiple choices)
Section - B - 5 questions (either a or b)
One problem is must (either a or b) in any unit

Section - C - 3 out 5 questions
Passing Minimum for Theory Paper(External):34 Marks.
Internal and External put together-50Marks.
Test: 20 Marks
Assignment :5 Marks

Question Papers in External Examination carrying 75 marks will be in the format below.

Type	No of questions to be answered	Marks
Section A	10	10
Section B	5	35
Section C	3	30

Practical
Internal - 40 marks (record-10 and model exam-30)
External - 60 marks
Total - 100 marks

Allocation of Papers and credits (semester wise) for PG programmes

(for those who joined in 2018 and after)

Semester-I

Sl. no.	Course	Subject Title	Code	Credits	Hours
1.	Core	CLASSICAL DYNAMICS	18PPHC11	5	6
2.	Core	ELECTRONICS, DESIGNS AND INSTRUMENTATION	18PPHC12	5	6
3.	Core	NUCLEAR,PARTICLE AND ASTROPHYSICS	18PPHC13	5	6
4.	Core	PRACTICAL - I	18PPHC1P	4	6
5.	Elective	CRYSTAL GROWTH AND THIN FILM TECHNIQUES/ FIBRE OPTICS COMMUNICATION	18PPHE11/ 18PPHE12	4	6
			Total	**23**	**30**

Semester-II

Sl. no.	Course	Subject Title	Code	Credits	Hours
1.	Core	MATHEMAICAL PHYSICS-I	18PPHC21	5	6
2.	Core	ELECTROMAGNETIC THEORY	18PPHC22	5	6
3.	Core	QUANTUM MECHANICS -I	18PPHC23	5	6
4.	Core	PRACTICAL-II	18PPHC2P	4	6
5.	Elective	QUANTITATIVE APTITUDE AND REASONING/ MICROPROCESSOR	18PPHE21/ 18PPHE22	4	6
			Total	**23**	**30**

Semester-III

Sl. no.	Course	Subject Title	Code	Credits	Hours
1.	Core	MATHEMATICAL PHYSICS -II	18PPHC31	5	6
2.	Core	CONDENSED MATTER PHYSICS -I	18PPHC32	5	6
3.	Core	PRACTICAL-III	18PPHC3P	4	6
4.	Elective	THERMODYNAMICS AND STATISTICAL MECHANICS / COSMO PHYSICS	18PPHE31/ 18PPHE32	4	6
5.	NME	MEDICAL PHYSICS AND OPTO ELECTRONICS	18PPHN31	4	6
			Total	**22**	**30**

Semester-IV

Sl. no.	Course	Subject Title	Code	Credits	Hours
1.	Core	QUANTUM MECHANICS-II	18PPHC41	5	6
2.	Core	CONDENSED MATTER PHYSICS -II	18PPHC42	5	6
3.	Core	PRACTICAL-IV	18PPHC4P	4	6
4.	Core	PROJECT	18PPHC4D	4	6
5.	Elective	SPECTROSCOPY AND NANOTECHNOLOGY/ COMPUTER ORIENTED NUMERICAL METHODS	18PPHE41/ 18PPHE42	4	6
			Total	**22**	**30**

Examination hours: Theory -3 Hours, Practical-3Hours

I M.Sc., Physics	Core Paper 1	Marks : 100
Semester I	CLASSICAL DYNAMICS	Hrs/ Week : 6
Code :18PPHC11		Credits : 5

Course Objective:

- To emphasize the mathematical formulation of mechanics problems and to physically interpret the solution.
- To apply the fundamental concepts of classical mechanics to the particle systems and Rigid bodies.

UNIT I

Mechanics of a system of particles - Conservation laws of linear and Angular momentum - Constraints - Generalised co-ordinates - Principle of virtual work - D'Alembert's Principle - Lagrangian equations of motion from D'Alembert's principle - Applications - Motion in a central field - Bead sliding on a uniformly rotating wire .

UNIT II

Variational method - Hamilton's equations of motion - Deduction of Hamilton's principle from the D'Alembert's principle - principle of least action - Applications - Motion of a particle in a central force field - Charged particle moving in an electromagnetic field.

UNIT III

Poisson bracket - Canonical transformations - Invariance of Poisson bracket with respect to canonical transformations - Hamilton - Jacobi theory – Kepler's problem - Action and angle variable - Solution of Harmonic oscillator problem by Hamilton - Jacobi equation - Hamilton's characteristic function conservative system.

UNIT IV

Generalised coordinates for Rigid body motion – Euler's theorem - Euler's angle – Angular velocity of rigid body – Angular momentum of rigid body – Moments and product of inertia – Rotational Kinetic energy of rigid body – Equation of motion of rigid body – Euler' equation.

UNIT V

Relativistic energy in terms of momentum - Energy conservation law - Transformation of momentum and energy - Force in relativistic mechanics - Minkowski space and Lorentz transformations - D'Alembert's operator - Lagrangian and Hamiltonian in relativistic mechanics - Introduction to general relativity.

Text books for Study:

1. Classical Mechanics by Gupta, Kumar and Sharma, Pragati Prakashan, New Delhi.

Books for Reference:

1. Classical mechanics by J.C.Upadhyaya, Himalaya publishing house, II edition 2005

2. Introduction to classical mechanics by T.G. Takwale and P. S. Purnaik. Tata McGraw Hill.

3. Classical mechanics by A. K. Raychaudri, Oxford University Press.

4. Classical mechanics of particles and rigid bodies by K. G. Gupta, Wiley Eastern.

I M.Sc., Physics	Core Paper 2	Marks : 100
Semester I	ELECTRONICS,DESIGNS AND INSTRUMENTATION	Hrs/ Week : 6
Code :18PPHC12		Credits : 5

Course Objective:

- To enhance comprehension capabilities of students through understanding of electronic devices
- To give clear understanding of operational amplifier and its importance
- To introduce the basic building blocks of integrated circuits.

UNIT I

Transistor – Basic ideas, Transistor as amplifier (CE), switch, series pass regulator, field effect transistor – Ideal voltage controlled current source, The junction field effect transistor, V-I characteristics, transfer characteristics, MOSFET – Volt-ampere characteristics, MOSFET as a resistance, switch, amplifier and CMOS – Basic devices

UNIT II

Internal structure and function of IC 741, non linear applications of OP amp, log, antilog amplifiers, regenerative comparators and active filters – OP amp based self oscillators, phase shift, Wien bridge and Non-sinusoidal oscillators, Voltage regulator – series voltage regulator, IC regulator, switching regulators – Solving simultaneous equation using OP amp.

UNIT III

Basics of logic gates AND, OR, NOT, NAND, NOR, EX-OR – Logic diagram, truth table, timing diagrams and their design of practical applications – 1's complement using NOT gate, a seat belt alarm system using AND gate, intruder detection system using OR gate, tank water level indicator using NAND and NOR, EX-OR gate as two bit modulo two adder using EX-OR – Digital integrated circuits – Performance characteristics and parameter of digital IC's 74series.

UNIT IV

Sequential logic – SR, JK, master slave, D and T flip flop – Level triggering and edge triggering – Frequency division using JK and D flip flop – Two, three, four, sixteen bit counters using JK flip flop – Asynchronous and synchronous type – Decade and modulo n counter – UP/DOWN synchronous counter – Ring counter – shift registers – Serial in – Serial out – Serial in parallel out – Parallel in serial out – Parallel in parallel out

UNIT V

Design of instrumental parameters – Passive transducers – Resistive transducers – Loading effect and sensitivity of bridge – Strain gauge – Capacitive transducers – Inductive transducers – Non linearity in the inductive transducer – Linear variable differential

transformer – Active transducer – Magnetic induction type transducer – Piezoelectric type transducers – Piezoelectric ultrasonic transducer

Text Books for study:

1. Digital fundamentals by Thomas L. Floyd, Pearson Prentice Hall England, (10^{th} edition) (2012).

2. Bio medical instrumentation by Dr. M. Arumugam, M. Sethuraman publishers (2002).

3. Micro electronics by Millman, J & Grabel A: Tata McGraw Hill, (2^{nd} edition), (2001).

4. Instrument Transducers – An introduction to their performance and design by Neubert H.K.P., Oxford University press Cambridge (2003).

Books for Reference:

1. Measurement systems – Application and design by Doebelin E.O and Manik. D.N., special Indian Edition, Tata McGraw Hill Pvt .Ltd. (2007).

2. Sensors and Transducers by D. Prantabis, Prentice Hall of India, 2^{nd} edition (2010).

I M.Sc., Physics	Core Paper 3	Marks : 100
Semester I	NUCLEAR , PARTICLE AND ASTROPHYSICS	Hrs/ Week : 6
Code :18PPHC13		Credits : 5

Course Objectives:

- To introduce students to fundamental principles and concepts governing nuclear and particle physics.
- To understand the concept of elementary particles.
- To understand the basic concepts of Astrophysics.

UNIT I

Nuclear Properties and Nuclear Models - Properties of atomic nucleus - Rutherford alpha scattering - Mass defect and packing fraction - Binding energy and stability of nucleus - Super heavy nuclei - Failure of proton - Electron model and proton neutron model - Liquid drop model and its applications - Exchange forces - Yukawa potential - Ground state and excited state of deuteron - Scattering length - Phase shift - Effective range theory.

UNIT II

Nuclear Reaction and Radioactive decays - Types of nuclear reaction - Nuclear chain reactions - Energy balance in nuclear reaction and Q-value - Four factor formula - Bohr-Wheeler's theory of nuclear fission -. Nuclear Fusion - Thermo nuclear reactions as source of stellar energy - Mechanism and kinematics of Radioactive Decays - Alpha decay - Gamow's theory of Alpha decay - β decay - Pauli's neutrino hypothesis and electron capture .

UNIT III

Introduction – Production of elementary particles – Types of interaction (Gravitational, Electromagnetic, Strong and weak) – Classification of elementary particles – Mass spectra and decays of elementary particles (Electrons, Meson, Neutrino, Hadrons, Mesons, Baryons) – Quantum numbers – Conservation laws – Black body radiation – Compton scattering - Pair Production.

UNIT IV

Stars - Stellar spectra - Colours of stars - Spectral classification of stars - Luminosity classification of stars – Hertzsprung - Russell diagram - Stellar evolution - Stellar population - Population I and II - Star clusters -Open clusters - Globular clusters - Variable stars - Energy generation in stars - PP and CN chain reactions - Derivation for Internal temperature and pressure of a star.

UNIT V

Sun - Internal Structure of Sun - Sun spots and magnetic fields on the sun - Solar activity - Hubble classification of galaxies - Spiral galaxies - Elliptical galaxies - Irregular galaxies - Dwarf galaxies - Milky way - Dark matter – Cosmological Models - Steady state

theory – Big bang theory - Hubble's law - White Dwarfs - Neutron stars and Black Holes - Expression for basic physics of black holes.

Text Books for Study:

1. Nuclear Physics by D.C. Tayal, Himalaya Publishing House, (5^{th} edition).

2. Introduction to nuclear and Particle Physics by V.K.Mittal, R.C.Verma, S.C.Gupta, PHI Learning Private Limited, (third edition) (2013).

3. Modern Astrophysics by Mark. L. Klutner, Cambridge University, London (2003).

4. Introduction to Astrophysics by A. Mujiber Rahman, KAMS Publication, (1^{st} edition), (2018).

Books for Reference:

1. Astronomy for Physicists by Arnab Rai Chaudri, Cambridge University, London (2010).

2. Modern Atomic and Nuclear Physics by A.B. Gupta, Books and Allied Private Limited (3^{rd} edition) (2015).

I M.Sc., Physics	Core Paper 4	Marks : 100
Semester I	**PRACTICAL I**	Hrs/ Week : 6
Code: 18PPHC1P		Credits : 4

Any Eight Experiments

1. Phase Shift Oscillator
2. Wien Bridge Oscillator
3. Emitter Follower
4. Two stage RC coupled amplifier with & without feedback
5. Refractive index of liquid using hollow prism
6. Anderson's Bridge
7. Optic bench Grating – Determination of wavelength of monochromatic sources
8. Thermistors – Temperature of coefficients of resistance
9. Stephen's constants
10. Thermal conductivity by Forbes method
11. Arc Spectrum – Constant deviation spectrography
12. UJT Relaxation Oscillator

I M.Sc., Physics	Elective Paper (1A)	Marks : 100
Semester I	CRYSTAL GROWTH AND THIN FILM TECHNIQUES	Hrs/ Week : 6
Code : 18PPHE11		Credits : 4

Course Objectives:

- To understand the theoretical concepts involved in crystal growth and thin film sciences.
- To acquire the knowledge about thin film coating and its characterization methods.
- To apply the knowledge of thin film in research level applications.

UNIT I

Introduction – Nucleation – Energy forming of nuclei – Spherical and cylindrical nuclei – Gibbs Thomson equation – Solvents – Solution – Solubility – Super Solubility – Expression for super saturation – Growth mechanism and classification – Solution growth – Low and high temperature solution growth – Slow cooling – Solvent evaporation method – Temperature gradient method.

UNIT II

Principle of gel technique – Various types of gel – Structure and importance of gel – Methods of gel growth and advantages – Hydrothermal growth – Melt technique – Czochralski growth – Bridgemen method – Flux growth – Vapour phase growth – Physical vapour deposition – Chemical vapour deposition

UNIT III

Nature of thin films – Emission conditions – distribution of deposits from point, surface and cylindrical sources – Deposition techniques: Vacuum evaporation – Pulsed laser deposition – Cathodic sputtering – Reactive sputtering – RF sputtering – Spray pyrolysis – Electro deposition – Substrate cleaning.

UNIT IV

Theories of thin film nucleation – Film growth – Incorporation of defects, impurities in thin film – deposition parameters and grain size - Interferometry – Fringes of equal thickness (FET) – Fringes of equal chromatic order (FECO) – Ellipsometry – Stylus profilometry – Vibrating quartz crystal method – Gravimetric balance method.

UNIT V

X-ray diffraction – Powder and single crystal – Fourier transform infrared analysis – Elemental dispersive X-ray analysis – Transmission and scanning electron microscopy – Uv-Vis-NIR spectrometer.

Books for study:

1. Crystal Growth for Beginners: Fundamentals of Nucleation Crystal Growth and Epitaxy by I.V. Markov 2nd edition (2004).

2. Crystal Growth Process and Methods by P.Santhanaragavan and P.Ramasamy, (KRU Publications, Kumbakonam (2001).

3. Thin Film Fundamentals by A. Goswami, New Age, New Delhi, (2008).

4. Materials Characterization Techniques by S.Zhang, L. Li and A. Kumar, CRC Press, Bota Racon (2009).

Books for Reference:

1. Materials Science of Thin Films by M.Ohring. (Academic Press, Boston) 2nd edition. (2002).

2. Characterization of Materials by E.N.Kaufmann, Volume-I John Wiley, New Jersey (2012).

I M.Sc., Physics	Elective Paper (1B)	Marks : 100
Semester I	FIBRE OPTICS COMMUNICATION	Hrs/ Week : 6
Code : 18PPHE12		Credits : 4

Course Objectives:

- To provide the basic elements of optical fibre transmission link, fibre modes configurations and structures.
- To explore the properties of optical fibres and how are they used to establish optical links for communication systems
- To develop students to design an optical link by choosing various parameters and components.

UNIT I

Forms of communication systems – The evolution of fibre optic systems – Elements of an optical fibre transmission link – Optical fibre modes and configurations – Fibre types – Rays and modes – Step index fibre structure – Single mode fibres – Graded into numerical aperture (NA).

UNIT II

Glass fibre – Halide glass fibres – Active glass fibres – Plastic – clad glass fibres – plastic fibres – Fibre fabrication – Outside vapour phase oxidation – Vapour phase axial deposition – Modified chemical vapour deposition – Double – crucible method.

UNIT III

Energy bands – Intrinsic and extrinsic material – The P junctions – Direct and indirect band gaps – Semiconductor device fabrication – LED – LED structure – Light source materials – Modulation capability – Laser diode modes and threshold condition – Laser diode structures and radiation patterns – Single mode laser – Physical principles of photodiodes – The pin photo detector – Avalanche photodiodes.

UNIT IV

Source to fibre power launching – source output patterns power – power launching versus wavelength – Equilibrium numerical aperture – Non-imaging microsphere laser diode of fibre coupling fibre to fibre joints – Mechanical misalignment.

UNIT V

Fibre and face preparation – Attenuation units – Absorption – Scattering losses – Bending losses – Core and cladding losses – Signal distortion in optical wave guide - Fibre splicing – Splicing techniques – Optical fibre connectors.

Text Books for Study:

1. Optical fibre communications by Gerd Keiser – II edition – McGraw – Hill International Edition (1991).
   Unit I : Chapter 1 & Chapter 2
   Unit II : Chapter 2
   Unit III: Chapter 3 & Chapter 4
   Unit IV: Chapter 5
   Unit V : Chapter 5

Books for reference:

1. Fibre optic communication systems by Govind P Agrawal – III edition – A John Wiley & Sons, INC., Publication (2002).

2. Optical fibre communications by John M Senior – PHI –II edition (2002).

I M.Sc., Physics	Core Paper 5	Marks : 100
Semester II	MATHEMATICAL PHYSICS I	Hrs/ Week : 6
Code :18PPHC21		Credits : 5

Course Objective:

- To develop knowledge in mathematical physics and its application
- To develop expertise in mathematical techniques required in physics
- To enhance problem solving skills

UNIT I

Gradient of a scalar field – Line,surface & volume integrals – Curl of a vector function & its physical significance – Gauss divergence theorem - Gauss law in differential form – Poisson's Equation – Laplace Equation – Stokes's theorem – Green's theorem – Green's theorem in a plane – Orthogonal curvilinear coordinates – Spherical polar coordinates (Gradient, Divergence, Laplacian) – Application to Hydrodynamics – Equation of continuity.

UNIT II

Review of Algebraic operations on matrices – Special types of matrices – Transpose of a matrix & its properties – The conjugate of a matrix – Symmetric & Antisymmetric matrices – Hermitian & Skew Hermitian – Solutions of Linear Equations – Linear Transformations – orthogonal & Unitary transformations – Similarity transformations – Eigen values ,Eigen vectors ,Characteristic Equation of a matrix – Cayley-Hamilton theorem.

UNIT III

Definitions - Symmetry property of Beta function - Evaluation of Beta functions- Transformation of Beta functions - Evaluation of Gamma functions - Transformation of Gamma functions - Relation between Beta and Gamma functions - Evaluation of MISCELLANEOUS integrals - MISCELLANEOUS important preposition

UNIT IV

Fourier's transform – Infinite Fourier sine & cosine transform – Properties of Fourier's transform – Modulation theorem – Convolution theorem – Parsevali's theorem – Derivative of Fourier transform – Fourier Sine & Cosine transforms of derivative – Fourier transform of function of two or three variables – Fourier finite sine and cosine transform – Application – solution of boundary value of the problem.

UNIT V

Linear Differential Equation - First order and its solutions – Method of separation variables –Method of integrating factor – Partial Differential Equations in physics – Solution of partial Differential Equations by the method of separation of two variables – Solution of Laplace Equation in Cartesian coordinates – Fourier equation of heat flow – Solution of heat flow.

Text Book for Study:

1. Mathematical physics by Satya prakash, sulthan chand&sons., NewDelhi (2006).

Books for Reference:

1. Mathematical physics by B.D.Gupta vikas Publishing house pvt Ltd, NewDelhi (2006).

2. Applied Mathematics tor Engineers and Physicists. by L.A.Pipes and L.R,Harvill - Mc Graw-Hill (1987).

3. Mathematical Physics by A.K.Ghatak,I.C.Goyal & S.J.Chua,,Mac Millan Insian Ltd., (1995).

4. Mathematical physics by H.K.Dass, S CHAND company Ltd (2004).

I M.Sc., Physics	Core Paper 6	Marks : 100
Semester II	ELECTROMAGNETIC THEORY	Hrs/ Week : 6
Code :18PPHC22		Credits : 5

Course Objectives:

- To understand the basic concepts of electrostatics, magnetostatics and Maxwell's equations
- To study the propagation of electromagnetic waves
- To learn electrostatics of macroscopic media

UNIT I

Electrostatic field's in a vacuum – The equations of Poisson and of Laplace - Conductors – Calculation of the Electric Field Produced by a simple Charge distribution - The Electric Dipole – The Linear Electric Quadrapole – Electric Multipoles Electrostatic Fields II : Dielectric Materials: The Electric Polarization – Electric Field at an Exterior Point – Electric Field at an Interior point- the Local Field - The Electric Susceptibility – The Divergence of E. The Electric displacement D – Calculation of Electric Fields Involving Dielectrics – The Clausius Mossotti Equation

UNIT II

The uniqueness Theorem – Solution of Laplace's Equation in Spherical Coordinates. Legendre's Equation, Legendre Polynomials. Magnetic Fields, I : Steady current and non magnetic materials - Magnetic Forces - The Magnetic induction B. The Biot Savart Law – The Divergence of point charge moving in am magnetic field – The Divergence of the Magnetic Induction B – The vector potential – The curl of the Magnetic Induction B – Ampere's circuital Law.

UNIT III

The Faraday Induction Law – The Induced Electric Field intensity E in terms of the Vector Potential A – Induced Electromagnetism in a moving system – Maxwell's equations: The conservation of electric charge – The potentials V and A. The Lorentz condition – The Divergence of E and the Non Homogeneous wave equation for A - The Curl of B – Maxwell's Equation.

UNIT IV

Propagation of Electromagnetic waves Plane wave infinite media. Plane Electromagnetic waves in free space – The E and H vectors in homogeneous, Isotropic, Linear and Stationary Media – Propagation of plane electromagnetic waves in non-conductors – Propagation of plane electromagnetic waves in Good conductors.

UNIT V

Propagation in a straight line – The coaxial line – Follow rectangular wave guide radiation of electromagnetic waves. Electric Dipole - The Scalar Potential – The Vector

Potential A and the magnetic field intensity of Electric Field Intensity E – The Average Poynting vector and the radiated power – Electric and Magnetic lines of force – The K surface.

Text Books for Study:

1. Electromagnetic Fields and Waves by Paul Lorain & Dale R.Corson ,CBs Publ. New Delhi. (1986).

I Chap (2) Secs 2.6 to 2.11 Chap (3) 3.1 to 3.13

II Chap (4) Secs.4.1 4.2 4.4 4.5 Chap (7) Secs 7.1 to 7.7

III Chap (8) Secs.8.1 to 8.3 Chap (10) Secs.10.1 to 10.7

IV Chap (11) Secs.11 to 11.5

V Chap (13) Secs. 13.1 to 13.3 Chap (14) Sec14.1.1 to 14.16

Books for Reference:

1. Fundamentals of Electromagnetic Theory by John R.Reitz, Federih J .Milford and Robert W.Christy. III Edition – Narosa Publishing House, New Delhi.

2. Classical Electrodynamics by J.D.Jackson

3. Introduction to Electrodynamics by D.J. Griffiths

4. Electromagnetic Waves and Radiating Systems by E.C.Jordan, PHI Pvt Ltd. New Delhi.

I M.Sc., Physics	Core Paper 7	Marks : 100
Semester II	QUANTUM MECHANICS I	Hrs/ Week : 6
Code :18PPHC23		Credits : 5

Course Objective:

- To understand the inadequacy of classical physics and the need for quantum theory of Radiation and matter.
- To learn the general formalism and the mathematical background of Schrodinger's quantum theory.
- To obtain analytical solutions of simple systems in one, two and three dimensions.

UNIT I

Limitation of classical physics - Planck's quantum Hypothesis - Einstein's theory of photoelectric Effect - Compton Effect - Quantum theory of specific heat - Bohr model of Hydrogen atom - Existence of stationary states - Elliptic orbits of Hydrogen atom - The Harmonic oscillator - The Rigid Rotator-particle in a Box - Inadequacy of quantum theory.

UNIT II

Wave Nature of particles - The uncertainty principle - The principle of Superposition - Wave packet - Time dependent Schrodinger equation - Interpretation of the Wave function - Ehrenfest's theorem - Time independent Schrodinger equation - Stationary states - Linear vector space - Linear operator - Eigen function and Eigen Values - Hermitian operator.

UNIT III

Postulates of Quantum mechanics - Simultaneous measurability of observable - General uncertainty relation - Dirac's equation - Equation of motion - Momentum Representation - Square well potential with rigid walls and finite walls – Square potential Barrier - Alpha emission - Bloch waves in a periodic potential.

UNIT IV

Linear Harmonic oscillator : Schrodinger method and operator method - Free particle in one dimensional Energy Eigen value Problem - particle moving in a spherical symmetric potential - system of two interaction particle - Rigid rotator - Three dimensional Square well potential - The Deuteron

UNIT V

The Schmidt orthogonalization procedure - Hilbert space - linear transformation - Dirac Bra-Ket notation - projection operator - Relationship between Kets and wave functions - Observables - Computability and Compatibility - Representation of linear operators in matrices - Adjoint of an operator - Inverse of an operator - Unitary operator - Similarity transformation or change of basis or unitary transformations and properties of unitary transformation - Matrix theory of the Harmonic oscillator - Two coupled Harmonic oscillator.

Text Books for study:

1. Quantum Mechanics by G.Aruldhas, PHI Learning Private Limited, Delhi, 2nd Edition, (2013).

2. Quantum Mechanics Theory and problems by S.L. Kakani, H.M. Chanadalia, Sultan Chand & Sons.

Books for Reference:

1. Quantum Chemistry by R.k. Prasad, New Agers International Publishers (4th Edition)

2. Quantum Mechanics by P.M. Mathews, K. Venkatesan Tata McGraw Education Private Limited, New Delhi Hill (2nd Edition)

3. Quantum Mechanics by L.L.Schiff, Tata McGrawW Hill, New Delhi (3rd Edition)

I M.Sc., Physics	Core Paper 8	Marks : 100
Semester II	**PRACTICAL II**	Hrs/ Week : 6
Code :18PPHC2P		Credits : 4

Any Eight Experiments

1. FET Amplifier
2. Amplitude Modulation
3. Saw - tooth Generation
4. Operational Amplifier - Integrator of Differentiator
5. Hyperbolic fringes
6. Optic bench - Biprism method
7. Hydrogen - Spectrum
8. Elliptical fringes
9. E/M Thomson method
10. Specific heat and liquid – Ferguson's method
11. Viscosity of liquid - Meyer's oscillation method
12. Wave shaping circuits

I M.Sc., Physics	Elective Paper (2A)	Marks : 100
Semester II	QUANTITATIVE APTITUDE AND REASONING	Hrs/ Week : 6
Code : 18PPHE21		Credits : 4

Course Objectives:

- To elicit the concepts of quantitative aptitude and reasoning.
- To develop familiarity with the main mathematical methods used in.
- To provide better understanding and ability to solve simple problems exactly.

UNIT I

Numbers-H.C.F. & L.C.M. of numbers – Decimal Fractions

UNIT II

Percentage – Profit & Loss – Ratio & Proportion – Partnership

UNIT III

Time & Work – Time & Distance – Area

UNIT IV

Verbal Reasoning: Logical Venn Diagrams – Alphabet Test – Mathematical Operations

UNIT V

Non-Verbal Reasoning: Classification (Odd Man Out) – Analytical Reasoning Spotting out the Embedded Figures – Complete the Incomplete Pattern

Text Books

1. Quantitative Aptitude by R.S. Aggarwal, S. Chand & Company Ltd, Reprint (2007).
   Unit I: Page nos. 3-29, 30-45, 46-66.
   Unit II: Page nos. 208-250, 251-293, 294-310, 311-325
   Unit III: Page nos. 341-370, 384-404, 499-548

2. Verbal and Non-Verbal Reasoning by R.S. Aggarwal, S. Chand & Company Ltd, Reprint (2015).
   Unit IV: Section I (Page nos. 441-481, 482-530, 569-596)
   Unit V: Section III (Page nos. 345-381, 382-407, 428-440, 441-457)

I M.Sc., Physics	Elective Paper (2B)	Marks : 100
Semester II	MICROPROCESSORS	Hrs/ Week : 6
Code : 18PPHE22		Credits : 4

Course Objectives:

- To understand the basic concepts of microprocessor.
- To acquire knowledge about the programming techniques of 8085 microprocessor.
- To understand techniques for faster execution of instructions and improve speed of operation and performance of microprocessors.

UNIT I

A detailed look at the 8085 MPU and its architecture 8085 programming – instructions Classification – Instruction format – how to wire, assemble and execute a simple program – Introduction to 8085 Instructions. Data transfer operation – Arithmetic operation – Logic operations- Branch operation – Writing assembly language program – Debugging a program.

UNIT II

Programming techniques with additional instructions – programming techniques: Looping, counting and indexing – Additional data transfer and 16 bit arithmetic instructions – Arithmetic operations related to memory – Logic operations: Rotate and compare – Dynamic debugging.

UNIT III

Counters and time delays – Counters and time delays – Illustrative programs – Hexadecimal counters –Zero to nine counters- Generating pulse wave form Debugging counters and time delay programs. Stack and subroutines; Stack – Subroutine - conditional call and return instructions – Advanced and subroutine concepts.

UNIT IV

Code conversion, BCD arithmetic and 16 bit data operation – BCD to binary conversion – Binary to BCD to conversion – BCD to seven segment LED ode conversion - BCD addition – BCD subtraction – Introduction to advanced instruction and applications multiplication – Subtraction with carry; interrupts – The 8085 interrupts – 8085 vectored interrupts – Restart software instructions.

UNIT V

Interfacing data converters; digital to analog converters – Analog to digital converters – 8255A Programmable peripheral interface.

Text Books for Study:

1. Microprocessor/ Architecture, programming and application with 8085 by Ramesh Gaonkar (Penram International Publishing, India – III Edition (1997).

Books for reference:

1. Fundamentals of microprocessor and Microcomputers by B.Ram. Dhanpat Rai, Publications (2005).

2. Microprocessors by A.P.Godse and D.A. Godse, Technical Publication, Pune (2005).
3. Introduction to Microprocessors by A.P.Mathur (II) Edition) Tata McGraw Hill Company, New Delhi.

II M.Sc., Physics	Core Paper 9	Marks : 100
Semester III	MATHEMATICAL PHYSICS II	Hrs/ Week : 6
Code :18PPHC31		Credits : 5

Course objectives:

- To introduce advanced mathematical methods in physics and their applications
- To enable students to use mathematical concepts required in physics
- To develop expertise in solving the complex problems in physics

UNIT I

Introduction- Functions of complex variables – Analytic function - Cauchy-Riemann differential equation - Cauchy-Riemann in polar form - Laplace's equation: Harmonic functions - Line integral of a complex function - Cauchy's integral theorem [elementary proof 1] - Cauchy's Integral formula

UNIT II

Singularities of an analytical function – Residues and Their Evaluation - Cauchy's Residue theorem - Evaluation of definite integrals - Integration round the unit circle - Evaluation of infinite integrals by Jordan's lemma

UNIT III

Laplace transforms-properties of Laplace transforms - Laplace transform of derivative of a function - Laplace transform of integrals - Application of Laplace transforms: square wave & saw tooth wave - Inverse Laplace transform : Fourier Mellin Theorem - properties of inverse Laplace transform

UNIT IV

Bessel - Legendre - Hermite differential equation - Series of solution and their polynomials - Rodrique's formula - Generating functions- Recurrence relation - Orthogonality relation - Application to Potential of a Hollow sphere - Linear Harmonic function

UNIT V

Introduction - Definition of probability - Events - Dependent and Independent events - Mutually Exclusive events - Compound probability - Measures of central tendency - Mean Median – Mode - Measures of dispersion - Range - Mean Deviation-Standard deviation - Binomial distribution - The Poisson distribution - Normal or Gaussian distribution - Distribution of a sum of normal variables

Text Book for Study:

1. Mathematical physics by Satya prakash, sulthan chand&sons., NewDelhi (2006).

Books for Reference:

1. Mathematical physics by B.D.Gupta vikas Publishing house pvt Ltd, NewDelhi (2006).

2.Applied Mathematics for Engineers and Physicists.L.A.Pipes and L.R,Harvill - Mc Graw-Hill (1987)

3. Mathematical Physics, A.K.Ghatak, I.C.Goyal & S.J.Chua, Mac Millan Insian Ltd., (1995)

4. Mathematical physics by H.K.Dass, S CHAND company Ltd (2004)

II M.Sc., Physics	Core Paper 10	Marks : 100
Semester III	**CONDENSED MATTER PHYSICS - I**	Hrs/ Week : 6
Code : 18PPHC32		Credits : 5

Course Objectives:

- To know the continuance in condensed matter physics in some central areas.
- To provide deep understanding on the crystal structure of materials.
- To gain the knowledge on phonons and the free electron Fermi gas.

UNIT I

Condensed Matter – Introduction – Solids – Crystalline – Single and Polycrystals – Amorphous – Crystal lattice – Basis (Motif) – Crystal structure – Crystal symmetry: Translational, Rotational, Mirror and Inversion – Primitive cell, Unit cell, Bravais lattices, Crystal planes, Directions and Family of planes – Miller indices – Interplanar spacing – Crystal structures: SC, FCC, BCC and Closed packed structures – Number of atoms in unit cell – coordination numbers (coordination type) – Radii ratio – Packing factor for SC, FCC, BCC and HCP – *c/a* ratio – Structure of NaCl, CsCl, Diamond and ZnS – Density calculations.

UNIT II

X-rays: Continuous and Characteristic X-rays – X-ray targets – Absorption of X-rays by material – X-ray diffraction – Bragg's Law – Reciprocal lattice – Reciprocal lattice for SC, FCC, BCC – Important properties of reciprocal lattices – Diffraction Intensity – Structure factor calculation for SC, FCC, BCC, NaCl and CsCl.

UNIT III

Atomic Bonding: Forces between Atoms – Cohesion of atoms and cohesive energy – Calculation of cohesive energy – Bonding in solids – Ionic bonding: Bonding energy of NaCl molecule – Calculation of madelung constant of ionic crystals – Properties and examples of ionic solids – Covalent bond: Directional nature of a covalent bond – Properties of covalent compounds – Metallic bonding and its properties.

UNIT IV

Crystal vibrations: Vibration of monoatomic lattices – Quantization of elastic waves – Phonon momentum – Thermal properties: Plank distribution for a system of identical harmonic oscillators – Density of states in one and three dimension – Einstein model – Debye model of specific heat, anhormonicity of lattice vibrations – Thermal expansion – Thermal conductivity and Umklapp processes.

UNIT V

Energy levels in one dimension – Fermi Dirac distribution for a free electron gas – Periodic boundary condition and free electron gas in three dimension – Heat capacity of the electron gas – Electrical conductivity and Ohm's law – Motion in magnetic fields – Hall Effect – Wiedemenn-Franz law – Energy bands: Nearly free electron model – Origin of the

energy gap – Block functions – Motion of an electron in a periodic potential Kronig Penny Model.

Text Books for Study:

1. Solid state physics by M.A. Wahab, 3rd edition (2015).
   Unit-I (Chapter 1)
   Unit-II (Chapter 8)
2. Solid State Physics by S.O. Pillai, 8th edition (2018).
   Unit-III (Chapter 3)
3. Introduction to Solid state physics by Charles Kittel, 8th edition (Reprint 2017).
   Unit-IV (Chapters 4&5)
   Unit-V (Chapters 6&7)

Books for reference:

1. Principles of the Theory of Solids by J.M. Zinam, 2nd edition (Cambridge) (1972).

2. Solid state Physics by N.W. Aschorft and N. D. Mermin (1976).

3. Intermediate Quantum Theory of the Crystalline Solids by A.O.E. Animalu, Prentice Hall of India (1977).

II M.Sc., Physics	Core Paper 11	Marks : 100
Semester III	PRACTICAL III	Hrs/ Week : 6
Code:18PPHC3P		Credits : 4

Any Eight Experiments

1. Active filters IC – 741 High, low band pass and band stop
2. IC – 555 Timer Astable and Monostable and Bistable
3. Solving simultaneous equation – IC 741
4. Multiplexer and Demultiplexer – IC 74151
5. Michelson – interferometer
6. Solar spectrum - Rydberg constant
7. Planck‘s constant
8. Modulo - n – Counter four bit
9. Refractive index of liquid using Newton’s ring
10. Wide band amplifier
11. Dielectric parameter of a given liquid
12. Determination of GM by Thomson method

II M.Sc., Physics	Elective Paper (3A)	Marks : 100
Semester III	**THERMODYNAMICS AND STATISTICAL MECHANICS**	Hrs/ Week : 6
Code :18PPHE31		Credits : 4

Course Objectives:

- To understand basic principles of thermodynamics.
- To develop an understanding of the statistical mechanics.
- To acquire the knowledge of various statistical distributions.

UNIT I

First law of thermodynamics and internal energy - Second law of thermodynamics - Reversible & Irreversible process - Carnot's engine and Carnot's cycle - Entropy & disorder - Thermodynamic potentials: Internal energy - Helmholtz functions – Enthalpy - Gibbs potential - Gibbs Helmholtz relations - Third law of thermodynamics - Nernst Heat Theorem - Maxwell thermodynamic relations - Two Tds equations - Latent heat equations

UNIT II

Triple point - Phase transition - Ratio of two specific heats- Difference of two specific heats ($C_p - C_v = TE\alpha^2 V$) - Joule Thomson effect - Joule Thomson effect for perfect and real gas - Application of paramagnetic salts : Magneto calorific effect -Vapour pressure of a liquid drop

UNIT III

Basic concepts - Microstates and macrostates - Phase space - Basic postulates of statistical mechanics – Ensembles - Canonical Ensembles - Micro canonical Ensembles - Grand canonical Ensembles - Entropy and Thermodynamical quantities - Liouville's Theorem - M-B statistics - B-E statistics - F-D statistics(No derivation)

UNIT IV

Derivation of Maxwell Boltzmann distribution law - Derivation of Bose Einstein statistics - Derivation of Fermi Dirac statistics - Eigen states and the M-B equations - B-E energy and pressure of the gas - Bose Einstein Condensation - F-D Energy and pressure of the gas - Electron gas

UNIT V

The monoatomic ideal gas - The distribution of molecular velocities - Specific heat capacity of a diatomic gas - The Einstein theory of a specific heat capacity of a solid - The Debye theory of a specific heat capacity of a solid - Black body radiation - Pauli's theory of paramagnetism - Free electron model and electronic emission - Brownian motion.

Text Books for Study:

1. Heat,Thermodynamics &statistical physics by S.L Kakani,S Chand & sons (2009).

Books for Reference:

1. Thermodynamics, Kinetic theory & Statistical thermodynamics by F.W.Swears & L.Salinga,Narosa publishing house.

2. Thermodynamics &statistical physics by Sharma & Sakar,Himalaya publishing house (2005).

3. Statistical mechanics by Donald A MC Quarrie,Viva books Pvt Ltd (2003).

4. Elementary statistical mechanics by Gupta Kumar,Pragati Prakashan

II M.Sc., Physics	Elective Paper (3b)	Marks : 100
Semester III	**COSMOPHYSICS**	Hrs/ Week : 6
Code : 18PPHE32		Credits : 4

Course Objective:

- To understand the composition of the universe better
- To reveal the truth & dispel the myths related to the universe
- To develop new techniques of observation for a better understanding of the solar system

UNIT I

Birth of Modern Astronomy - Geocentric and Heliocentric - Celestial sphere - Coordinate systems - Horizontal and equatorial systems - Kepler's law - Postulates of General theory of relativity - Elements of the telescope - Properties of images - Aberrations of telescopes - Kinds of Optical telescopes

UNIT II

Refracting and Reflecting telescopes - Schmidt telescope - Magnification of telescope - Radio telescope-Spectrograph - Limitation - The orientation of Earth in space – Seasons - Precession of the Earth - Arc and time units - Time keepers - Sidereal time - Local time - Standard time

UNIT III

Planets - Terrestrial and Jovian planets (Planets individual description is not required in detail) - Satellites - Asteroids - Meteoroids - Comets - Physical properties - Composition - Photosphere - Chromosphere - Corona- Sunspots - Sunspot groups - Sunspot cycle - Solar Prominences - Solar Flares - Solar Wind - Communication disturbances - Auroras

UNIT IV

Classification of spectra of stars - Hertzsprung - Russel diagram - Luminosity of a star - Photon diffusion time – Mass - Luminosity relation for a star - Nuclear reactions - stellar Evlolution - White dwarfs - Chandrasekhar limit - Neutron stars - Black holes - Basic physics of Black hole

UNIT V

Identifying Galaxies - Galaxy nomenclature - Types of Galaxies - Spiral – Elliptical - Irregular galaxies - Milky Way and its structure - Properties of Galaxies - Mass of a binary system - Star clusters - Galaxy clusters - Pulsars

Text Books for Study:

1. Introductory Astronomy by Niclolas.A.Pananides and Thomas Arny, Addison Wesley Publ. Co. (1979).

2. Introduction to Astrophysics by A. Mujiber Rahman, KAMS Publications, Uthamapalayam (2018).

Books for Reference:

1. Astronomy A physical perspective by Marc L. Klutner, Cambridge University, UK (2003).

2. Astrophysics by Abhyankar, K.D, Universities Press, Delhi (2002).

II M.Sc., Physics	Non Major Elective Paper	Marks : 100
Semester III	MEDICAL PHYSICS & OPTO ELECTRONICS	Hrs/ Week : 6
Code:18PPHN31		Credits : 4

Course Objectives:

- To discuss in detail the working of various medical instruments and to provide practical Knowledge regarding the same
- To create an awareness in the students about the banes and boons of nuclear radiation
- To help students appreciate the beneficial uses of radiation

UNIT I

Transducers - Characteristics of transducers - Static and dynamic active transducers - Magnetic induction type - Piezo electric type - Photo voltaic type – Thermo electric type - Passive transducers - Resistive type - Effect and sensitivity of a bridge - Capacitive transducer - Linear variable differential transformer (LVDT)

UNIT II

Characteristics of basic recording system - Electro Cardio Graphy (ECG) - ECG leads - Unipolar and bipolar - ECG recording setup - Electroencephalo graph (EEG) – Origin - Block diagram of EEG unit

UNIT III

Electro myograph (EMG) - Block diagram of EMG recorders - Digital thermometer - Computer tomography (CT) principle - Block diagram of CT scanner

UNIT IV

Introduction- p n junction as a light source- LED materials - Advantages - LCD characteristics and action of LCD - Advantages - Principle of optical fibre - Light transmission in a optical fibre - Acceptance angle numerical aperture - Fibre index profiles - Step index graded index fibre - Advantages of fibre in optic communications - Optical switching - logic gate

UNIT V

Laser - Emission and absorption of light - Spontaneous and stimulated emission - Laser principle - Einstein's co-efficients - Applications - Construction, working and characteristics of ruby laser - He – Ne laser, Semiconductor laser

Text Books for study:

1. Biomedical Instrumentation, by Dr.M.Arumugam (1994)

2. Semiconductor physics and opto electronics, by P.K. Palanisamy

Books for Reference:

1. Hand book of Biomedical instrumentation by R.S. Khanpur, Tata-Mcgraw Hill (1999).

2. Modern Physics by G. Aruldhas and P. Rajagopal

II M.Sc., Physics	Core Paper 12	Marks : 100
Semester IV	QUANTUM MECHANICS II	Hrs/ Week : 6
Code :18PPHC41		Credits : 5

Course Objectives:

- To learn the use of approximation methods of quantum mechanics.
- To introduce relativistic mechanics: Klein – Gordan and Dirac equations.

UNIT I

Stationary state perturbation theory - Degenerate and non Degenerate case - Effect of electric field on energy level of hydrogen atom - Variational principle – Rayleigh - Ritz method - Ground state of Helium atom - Time dependent perturbation theory - Harmonic perturbation - Transition to continuum states - Fermi's golden rule

UNIT II

Sudden approximation - Adiabatic approximation - Scattering theory of Born approximation - Condition for validity of Born approximation - Scattering by a screened coulomb potential – Partial wave analysis

UNIT III

Physical meaning of identity – Symmetric & Antisymmetric wave function - Construction from Antisymmetrized function - Pauli Exclusion Principle - Spin angular momentum.

UNIT IV

Three Dimensional problem - Hydrogen atom –Energy eigen values – Wave functions of hydrogen like atom – Radial probability Density - Hydrogenic Orbitals - A Free particle - Three dimensional square well potential - Ground state of deuteron – Symmetry of two interacting particle.

UNIT V

Klein Gordan equation for free particle- Dirac'sMatrices - Covariant form of dirac equation - Probability density for charge & current - Plane wave solution of Dirac's equation- Negative energy state - Dirac's equation for a electron in central potential- Spin of dirac partial.

Text book for Study:

1. Quantum Mechanics by G.Aruldhas, PHI Learning Private Limited, Delhi2nd Edition (2013).

2. Quantum Mechanics Theory and problems by S.L.Kakani, H.M.Chanadalia, Sultan Chand & Sons.

Books for Reference:

1. Quantum Chemistry by R.k. Prasad, New Agers International Publishers (4th Edition)

2. Quantum Mechanics by P.M.Mathews, K.Venkatesan Tata McGraw Education Private Limited , New Delhi Hill (2nd Edition)

3. Quantum Mechanics by L.L.Schiff, Tata McGrawW Hill, New Delhi (3rd Edition)

II M.Sc., Physics	Core Paper 13	Marks : 100
Semester IV	**CONDENSED MATTER PHYSICS - II**	Hrs/ Week : 6
Code : 18PPHC42		Credits : 5

Course Objectives:

- To provide the basic knowledge and current problems within the field of condensed matter mainly on functional materials.
- To understand certain properties and phenomena of solid states.
- To create the people to pursue physics as a teaching and research career.

UNIT I

Semiconductors: Intrinsic and Extrinsic semiconductors – Carrier concentration in semiconductors – Fermi level and carrier concentration in semiconductors – Mobility in charge carriers – Effect of temperature on mobility – Electrical conductivity of semiconductors – Hall effect in semiconductors – Junction properties: Metal-Metal junction – Metal-Semiconductor junction – Semiconductor-Semiconductor (p-n) junction.

UNIT II

Dielectrics: Dipole moment and Polarization – Electric field of dipole – Local electric field at an atom (Depolarization, Lorentz and Dipoles) – Dielectric constant and its measurement – Polarizability: Electronic and Ionic – The classical theory of electronic polarizability – Dipolar polarizability – PIEZO-PYRO-AND ferroelectric properties of crystals – Ferroelectricity – Ferroelectric domain.

UNIT III

Optical properties: Absorption processes – Photoconductivity and its measurement – Photoelectric effect – Photovoltaic effect – Photoluminescence and Colour centers – Types of colour centers: Electronic and Hole – Generation of colour centers – Maser and Laser: Absorption and Emission – Population Inversion – Ammonia-Beam maser – Types of laser.

UNIT IV

Magnetic properties: Classification of magnetic materials – Atomic theory of magnetism – Origin of permanent magnetic moments – Langevin's classical theory: Diamagnetism and Paramagnetism – Quantum theory of paramagnetism – Ferromagnetism – Weiss molecular field – Temperature dependence of spontaneous magnetization – Ferromagnetic domains –Domain theory – Antiferromagnetism – Ferromagnetism and Ferrites.

UNIT V

Superconductivity: Occurrence of superconductivity – Response of magnetic field to superconductivity – The meissner effect – Thermodynamics of superconducting transition – Origin of energy gap – London equation – London penetration depth – Coherence length – Elements of BCS theory – Flux quantization – Normal tunneling and Josephson Effect – High-T_C superconductivity

Text Books for Study:

1. Solid state physics, M.A. Wahab, 3rd edition (2015).

Unit-I (Chapter 13)
Unit-II (Chapter 14)
Unit-III (Chapter 15)
Unit-IV (Chapter 16)
Unit-V (Chapter 17)

Books for reference:

1. Solid State Physics by S.O. Pillai, 8th edition (2018).

2. Introduction to Solid state physics by Charles Kittel, 8th edition (Reprint 2017).

II M.Sc., Physics	**Core Paper 14**	**Marks : 100**
Semester IV	**PRACTICAL IV**	**Hrs/ Week : 6**
Code 18PPHC4P		**Credits : 4**

Any Eight Experiments

1. JK up -down counter four bit
2. Ring counter
3. Twin T Notch filters using IC and its characteristics
4. Karnaugh mapping
5. Shift Register - Serial in/ Serial out SISO/SIPO
6. Quincke's method - Study of susceptibility of diamagnetic materials
7. Guoy's method - Study of susceptibility of diamagnetic materials
8. Hall effect
9. Ultrasonic studies - velocity of sound
10. Encoder and Decoder
11. Four probe Experiment
12. Push pull power Amplifier

II M.Sc., Physics	**Core Paper 15**	**Marks : 100**
Semester IV	**PROJECT**	**Hrs/ Week : 6**
Code :18PPHC4D		**Credits : 4**

- Thin film Technology
- Nano material growth and characterisation
- Electronics and Interfacing
- Ultrasonic studies
- Astrophysics
- Structural Analysis
- Electron density and Bonding
- Crystal Growth

II M.Sc., Physics	Elective Paper (4A)	Marks : 100
Semester IV	SPECTROSCOPY AND NANO TECHNOLOGY	Hrs/ Week : 6
Code :18PPHE41		Credits : 4

Course Objectives:

- To emphasize the modern developments in experimental techniques especially spectroscopy.
- To comprehend the principles of nanotechnology.
- To enable the student to explore the field of nanomaterials.

UNIT I

Introduction - Rotational spectra of molecules - Rigid diatomic molecules - Frequency of rotational spectral lines - Theory of IR absorption spectroscopy - Energy of diatomic molecule - Vibrational spectra of diatomic molecule as a Harmonic and anharmonic oscillator - Modes of vibrations of atoms in polyatomic molecules - Limitations of IR spectroscopy - Applications of IR spectroscopy in organic and inorganic complexes

UNIT II

General theory - Interaction of X - rays with matter - Application of X-rays - Absorption method - Qualitative and Quantitative analysis - Particle determination - theory of Electron spin Resonance Spectroscopy - Instrumentation - Presentation of Electron spin Resonance Spectroscopy - Hyperfine splitting - Line width - Limitations of Electron spin Resonance Spectroscopy - Applications of Electron spin Resonance Spectroscopy - Structural determination.

UNIT III

Raman Spectroscopy - properties of Raman lines - Difference between Raman and infrared Spectra - Classical and Quantum theory of Raman effect - Rotational and Vibrational Raman Spectra - Applications in organic, inorganic and physical chemistry - Origin of NMR Spectra - Technique and principle - Interpretation of NMR Spectra - Chemical shift and Spin - Spin splitting - Coupling constant - Applications of NMR spectroscopy - Qualitative and Quantitative analysis.

UNIT IV

Introduction - nano, nanoparticles and its properties - Types of nanostructured materials - Zero, One, Two and Three dimension - Fabrication of nanostructured materials - plasma arching - chemical vapour deposition - Electro deposition - chemical precipitation- Characterizations of nano structured materials - Photoluminescence spectroscopy - Scanning Electron Microscope - High Resolution transmission Electron Microscopy - X-Ray Diffractometer

UNIT V

Semiconductor Quantum dots and confinement - Synthesis of Quantum Dots - Molecular precursors - modification of surface of nanocrystals - Electronic structure of Nanocrystals - Applications of Quantum dots - Nanosensors - Nanosensors based optical properties - Quantum effects - Electrochemical sensors - Sensors based on physical properties

Text Books for Study:

1. Spectroscopy by B.K.Sharma, GOEL publishing House, Meerut.

2. Introduction to Spectroscopy by L.Pavia, M.Lampman, S.Kriz and R.Vyvyan, Cengage Learning India Pvt. Ltd.

3. Nano-The Essentials Understanding Nanoscience and Nanotechnology by Pradeep.T, MC Craw Hill Education Private Limited.

Books for Reference:

1. Introduction to molecular spectroscopy by G.M.barrow, MC Graw-Hill, Kogakusha, Ltd

2. Nanoscience and Nanotechnology by K.K.Choudhary, Narosa Publishing House.

II M.Sc., Physics	Elective Paper (4b)	Marks : 100
Semester IV	**COMPUTER ORIENTED NUMERICAL METHODS**	Hrs/ Week : 6
Code :18PPHE42		Credits : 4

Course Objective :

- To provide the student with numerical methods of solving the non-linear equations , interpolation ,differentiation and integration
- To improve the student skills in numerical methods by using the numerical analysis software and computer facilities

UNIT I

Introduction – Beginning an iterative method – the method of successive bisection – Newton Raphson iterative method –The secant method – The method of successive approximations – comparison of iterative methods.

UNIT II

Introduction – The Gauss determination method – Pivoting – III conditioned equations, Refinement of the solution defined by Gaussian elimination – The Gauss – Seidal iterative method – An algorithm to moment the Gauss-Seidal method – comparison of direct and iterative methods.

UNIT III

Interpolation, Lagrange interpolation – difference tables – Truncation error in interpolation – Least squares approximation of functions – Linear regression – Algorithm linear regression.

UNIT IV

Formulae for numerical integration – Simpson's – Gaussian quadrature formulae – Numerical solution of differential Equations –other order differential equations.

UNIT V

Programs for 1.Solution of an equation by iterative method (Newton Raphson method) 2. Solution of simultaneous equations. 3. Calculation of mean and variance. 4. Calculation of correlation Coefficients – Linear suppressions. 5. Solution of first order differential equation (Runge – Kutta method) 6. Solution of II order differential equation (Runge-Kutta method) 7.Evaluation of definite integrals (Trapezoidal and Simpson rule) 8. Evaluation on inverse of a matrix 9.Calculation of matrix polynomial. ***(Programme in C Language only)***

Text Books for Study:

1. Computer oriented Numerical Methods by V.Rajaraman, II Edition, Prentice Hall of India Pvt. Ltd (1989).

Unit – I Chap.3 Sec.3.1 to 3.8

Unit – II Chap 4 (All secs)

Unit – III Chap(5) 5.2 to 5.4 Chap (6) Secs.6.2 & 6.3

Unit – IV Chap(8) Secs 8.2 8.3 8.4 & 8.8 Chap(9) Sec.9.7

2.Numerical Methods for Scientific and Engineering Computation by M.K.Jain. S.R.K.Iyengar, and R.K.Jain, New Age International Publishers (Unit V).

Books for Reference:

1.Elementary Numerical Analysis An Algorithmic Approach – S.D.Conte & Carl Boor, Third Edition – McGraw Hill international company (1983).

2.Numerical Methods for Engineers – Steven C Chopra, Rayamond P.Canale Second Edition – McGraw Hill International Editions, (1990).

3.Numerical Algorithms – Computations in Science and Engineering. E.V.Krishnamurthy and S.K.Sen – Affiliated East West Press Pvt. Ltd., New Delhi (1993).

4.Programming in C – S. Ramaswamy and P. Radhaganesan Second edition – Scitech publishers.