HAJEE KARUTHA ROWTHER HOWDIA COLLEGE

(An Autonomous Institution Affiliated to Madurai Kamaraj University, Madurai.)
(Re-Accredited at "A" Grade, by NAAC,Banglore)

UTHAMAPALAYAM – 625533.

DEPARTMENT OF PHYSICS

MASTER OF SCIENCE – PHYSICS

(Effect from the Academic Year 2017 – 2018 Onwards)

PROGRAMME SPECIFIC OUTCOMES:

PSO1. Understand the nature and basic concepts in physics including the classical mechanics, EM and modern physics

PSO2. Elicit the analytical methods required to interpret and analyse results and draw conclusions as supported by the data

PSO3. Utilise a wide range of printed and electronic resources and information technologies to support research on physical systems and physical phenomena

PSO4. Design and conduct experiments demonstrating scientific methods and processes

PSO5. Demonstrate communication skills related to physics and the impact of physics in daily life

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 2017 – 2018)

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 2017 and after)

Semester-I

Sl. no.	Course Category	Title of the Course	Course Code	Credits	Hours
1.	Core	MATHEMATICAL PHYSICS – I	17PPHC11	5	6
2.	Core	CLASSICAL MECHANICS	17PPHC12	4	5
3.	Core	APPLIED ELECTRONICS	17PPHC13	4	5
4.	Core	PRACTICAL-I	17PPHC1P	5	8
5.	Elective	COMPUTER ORIENTED NUMERICAL METHODS	17PPHE11	5	6
6.	Elective	FIBRE OPTICS COMMUNICATION	17PPHE12		
			Total	**23**	**30**

Semester-II

Sl. no.	Course Category	Title of the Course	Course Code	Credits	Hours
1.	Core	MATHEMAICAL PHYSICS-II	17PPHC21	5	6
2.	Core	ELECTROMAGNETIC THEORY	17PPHC22	4	5
3.	Core	STATISTICAL MECHANICS AND THERMODYNAMICS	17PPHC23	4	5
4.	Core	PRACTICAL-II	17PPHC2P	5	8
5.	Elective	NANO PHYSICS	17PPHE21	5	6
6.	Elective	MEDICAL PHYSICS	17PPHE22		
			Total	**23**	**30**

Semester-III

Sl. no.	Course Category	Title of the Course	Course Code	Credits	Hours
1.	Core	SOLID STATE PHYSICS-I	17PPHC31	4	6
2.	Core	QUANTUM MECHANICS-I	17PPHC32	4	5
3.	Core	PRACTICAL-III	17PPHC3P	5	8
4.	Elective	APPLIED OPTICS AND LASER PHYSICS	17PPHE31	4	5
5.	Elective	COMPUTER PROGRAMMING IN C++	17PPHE32		
6.	NME	MICROPROCESSORS	17PPHN31	5	6
			Total	**22**	**30**

Semester-IV

Sl. no.	Course Category	Title of the Course	Course Code	Credits	Hours
1.	Core	SOLID STATE PHYSICS-II	17PPHC41	4	6
2.	Core	QUANTUM MECHANICS-II	17PPHC42	4	5
3.	Core	NUCLEAR AND PARTICLE PHYSICS	17PPHC43	4	5
4.	Core	PRACTICAL-IV	17PPHC4P	5	8
5.	Elective	PROJECT	17PPHE41	5	6
6.	Elective	MOLECULAR SPECTROSCOPY	17PPHE42		
			Total	**22**	**30**

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

I M.Sc., Physics		Marks : 100
Semester I	MATHEMATICAL PHYSICS - I	Hrs/ Week : 6
Code :17PPHC11		INT : 25, Ext : 75

Course Outcomes:

- 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

Vector Spaces and Transformations – Review of Algebraic Operations on matrices. – Special Matrices – Partitioning of Matrices. System of Linear Equations - Particular cases – System of Linear equations General - The Eigen Value Problems.

The gradient – The divergence and Gauss's Theorem – Curl of a vector field and Stoke's theorem – Successive application of the operator - Orthogonal curvilinear coordinates – Application to hydrodynamics – Equations of heat flow in solids.

UNIT II

Taylor's Series – Symbolic form of Taylor's series – Evaluation of integrals means of Power Series – Fourier Series and Integrals –Fourier series – Examples of Fourier expansions of functions – Some remarks about Convergence of Fourier Series – Fourier Transform - Properties of Fourier Transforms – Fourier Transform of a derivative – Fourier sine Cosine Transforms of derivatives – Fourier transform of functions of two or three variables – Finite Fourier transforms – Applications of Fourier Transform.

UNIT III

Bessel's Differential Equation – Series solution of Bessel's Differential Equation. Bessel Function of order n of the Second kind- Values of Jn(x) and Yn(x) for Large and Small values of x – Recurrence Formula for Jn (x) when n is Bessel Functions – Modified Bessel Functions Expansion in series of Bessel Functions – The Bessel Coefficients.

UNIT IV

Legendre's Differential Equation – Rodrigue's formula for the Legendre Polynomial Legendre's function of the second kind – The generating function for Pn – The Legendre coefficients – The Orthogonality of P_n (x) - Expansion in series of Legendre polynomials – The Gamma Function – Gauss's Pi Function – The of $\sqrt{}$ 1/ 2 and Graph of the Gamma Function – The Beta Function – The connection of Beta Function and the Gamma Function.

UNIT V

Hermite Differential Equation and Hermite Polynomials – Generating funtion Hermite Polynomials – Recurrence formulae for Hemrite Polynomials – Rodrigue's Formula for Hermite Polynomials – Orthogonality of Hermite Polyomials – Laguerre's Differential Equation and Laguerre Polynomials – Generating Functions for Laguerre Polynomials – Rodrigue's Formula for Laguerre Polynomials – Recurrence Relations for Laguerre Polynomials – Orthogonal Property of Laguerre Polynomials.

Associated Laguerre Differential Equation and Associated Laguerre Poloynomials Generating function for Associated Laguerre Polynomials – Rodrigue's Representation Associated Laguerre Polynomials – Orthogonal Property of Associated Laguerre Polynomials – Recurrence Formulae for Associated Laguerre Polynomials.

Text Book for study :

Applied Mathematics for Engineers and Physicists by Pipes and Harvill – III Edition – Mc Graw Hill International Book Company (1970)

Appendix B Sections 2 – 7, 9, 10, 12-26.

Appendix C Sections 15 – 17, 21-24, 28

Appendix E Sections 8 – 14.

Mathematical physics – Sathya Prakash (Revised Edition 2002)

Chapter 6 : Section 6.29 – 6.43.

Matrices and Tensors in Physics – A. W.Joshi II Edition – Chapter 1.1 to 1.10 Wiley Eastern Ltd.

Books for reference:

Mathematical Physics – Eugene Butkov – Addison – Wesley Publishing Company. Mahematical Physics for Physicists – George B.Arfken and Hans J.Weber – Fourth Edition – Prism Books Pvt. Lt., Bangalore (1994)

Mathematical Physics – B.D. Gupta. Third Edition 2005 (Vikas Publishing House Private Ltd, New Delhi)

Mathematical Physics – H.K.Dass, Fourth Edition 2004 (S.Chand & Company Ltd., New Delhi)

M.Sc., Physics		Marks : 100
Semester I	CLASSICAL MECHANICS	Hrs/ Week : 5
Code : 17PPHC12		INT : 25, Ext : 75

Course Outcomes :

- 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.
- To develop problem solving and critical thinking skills.

UNIT I

Generalised Coordinates – Lagrangian equations of motion – Variational Principle and Lagrangian equations of motions – Hamiltonian equations of motion – Cyclic coordinates and Routh's procedure – physical significance of the Hamiltonian – Hamilton's equations from Variational principle – The principle of least action – simple applications.

UNIT II

Motion under a central force – General features of central force motions – Reduction of two-body central force problem to the equivalent one body problem – Equation of motion in a central field – Equation for an orbit in a central field – Conditions for closed orbits (Bertrand's theorem) – The Virial theorem – Kepler's laws of planetary motion – Scattering in a central force field – Rutherford's Alpha particles Scattering.

UNIT III

The equations of Canonical transformation – Examples of canonical transformations – Harmonic Oscillator – Lagrange and Poisson brackets – Equations of Motion in Poisson bracket notation – Liouville's theorem.

UNIT IV

Formulation – The Eigen value equation and the principal axis transformation – frequencies of free vibrations and normal coordinates. Free vibrations of a linear triatomic molecule and some macroscopic applications.

UNIT V

Hamilton – Jacobi Equation – Applications : Harmonic Oscillator and Kepler's problem – The Hamilton – Jacobi Equation for Hamilton's Characteristic Function – Action and Angle Variables – Harmonic Oscillator problem using Action and Angle Variables – Kepler's problem in Action – Angle Variables.

Text Books for Study:

Classical Mechanics – Goldstein II Edn (1980) Addison Wesley. World student Edn. Chapter: 3,6,8,9,10

Books for reference:

1. Introduction to Classical Mechanics – R.G.Takwale and P.S.Puranik, Edn.(2004) Tata McGraw – Hill Publishing Company Limited, New Delhi.
2. Classical Mechanics – Gupta Kumar Sharma, Edn.(2005) Pragati Prakashan, Meerut.
3. Classical Mechanics – K.Sankara Rao, Edn.(2005) PHI Private Ltd. New Delhi.
4. Classical Mechanics – J.C.Upadhyaya II Edn.(2005) Himalaya Publishing House.
5. Classical Mechanics – Aruldhas.

I M.Sc., Physics		Marks : 100
Semester I	APPLIED ELECTRONICS	Hrs/ Week : 5
Code :17PPHC13		INT : 25, Ext : 75

Course Outcomes:

- 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

Amplitude Modulation: Theory - Frequency Spectrum of the AM wave. Representation of AM, Power Relations in the AM wave, Generation of AM : Basic requirements, Grid and Plate Modulated Class C Amplifications – Modulated Transistor Amplifiers, Single – side band Techniques Evolution and description of SSB, suppression of carrier, Suppression of Side band, Extensions of SSB.

UNIT II

Description of frequency and phase modulation – Mathematical representation of FM – Frequency spectrum of the FM wave. FM and phase modulation intersystem comparisons – Effects of noise on carrier –pre emphasis and de emphasis. Other forms of interference – Comparison of wide band and narrow band FM – Stereophonic FM multiple systems – Generation of FM, Direct and Indirect methods – stabilied resistance modulator – AFC Indirect Method.

UNIT III

Type of pulse modulation, pulse width, pulse positions and pulse code modulation – Operational Amplifier : Basic operational amplifier: The differential amplifier – The emitter – Coupled differential amplifier – Offset error Voltages and currents – Temperature drift of input offset voltage and current – Measurement of operational amplifiers – dominant – Pole, Pole-zero and lead compensation.

UNIT IV

FET UJT small signal model – MOSFET – Common source amplifier follower – Generalised FET amplifier – Biasing the FET – FET Voltage – variable resistor – The unijunction transistor – UJT as a relaxation oscillator Four layer diode V-I Characteristics Silicon controlled rectifier. Power control – Triac Microwave devices, components and circuits: Microwave diodes – Multicavity Klystron. Reflex Klystron, magnetron - Gunn effect and diodes – directional couplers, isolations and circulators, mixers, detectors and detector mounts, T – junctions Magic eye and its applications.

UNIT V

Digital Elements – Simplification of Boolean functions – The map method Four variables map – Product of sums simplifications – NAND and NOR implementations – Don't care conditions. Flip flops – Analysis of clocked sequential circuits. Desi procedure – Design of counters - Design with state equations.

Books for study:

1. Electronic Devices and Circuits – Millman & Halkias. McGraw The International book Company.

2. Electronics communication System – George Kennedy III edition Graw Hill Company.

***Books for reference*:**

1. Integrated Electronics – Millman & Halkias, Tata McGraw Hill Company.

2. Digital Logic and Computer Design – M.Morris Mao, Prentice Hall, India.

I M.Sc., Physics		Marks : 100
Semester I	PRACTICAL - I	Hrs/ Week : 8
Code :17PPHC1P		INT : 40, Ext : 60

Practical I – First Year – I Semester – Electronics (Any Eight Experiments)

1. FET Amplifier
2. Amplitude Modulation
3. Operational Amplifier Characteristics
4. IC Regulated power supply
5. Phase shift Oscillator
6. Wien Bridge Oscillator
7. Saw tooth wave generator
8. Emitter follower
9. UJT – Relaxation Oscillator
10. Two stage RC coupled amplifier – with and without feedback
11. Wave shaping circuits
12. Passive filter circuits – low, high and band pass filters.

I M.Sc., Physics		Marks : 100
Semester I	COMPUTER ORIENTED	Hrs/ Week : 6
Code :17PPHE11	NUMERICAL METHODS	INT : 25, Ext : 75

Course Outcomes:

- To study the errors and measurements
- To learn Algebraic, transcendental equations and interpolation
- To program computer programming

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 – V.Rajaraman II Edition 1989 Prentice Hall of India Pvt. Ltd.

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)

I M.Sc., Physics	Major Elective Paper 5 (b)	Marks : 100
Semester I	FIBRE OPTICS COMMUNICATION	Hrs/ Week : 6
Code :17PPHE12		INT : 25, Ext : 75

Course Outcomes:

- To provide the basic elements of optical fiber transmission link, fiber modes configurations and structures.
- To explore the properties of optical fibers 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 vapor 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:

Optical fibre communications by Gerd Keiser – II edition – McGraw – Hill International Edition 1991.

Unit I : Chapter 1 – Secs. 1.1,1.2, 1.3

Chapter 2 Secs.2.31 to 2.3.3, 2.5.1, 2.5.2, 2.6.2, 2.6.2

Unit II : Chapter : 2 Sections 2.7, 2.7.1 to 2.7.5, 2.8, 2.8.1 to 2.8.5

Unit III : Chapter : 3 Sections 4.1, 4.1.1 to 4.1.5, 4.2, 4.2.1, 4.2.2,4.3,4.3.1 to 4.3.6

Chapter 6 : Sections 6.1, 6.1.1, 6.1.2

Unit IV : Chapter 5 Sections 5.1, 5.1.1 to 5.1.4, 5.2, 5.2.1

Unit V : Chapter 5 Sections 5.3, 5.3.1, 5.3.3, 5.5, 5.5.1, 5.6.5

I M.Sc., Physics		Marks : 100
Semester II	MATHEMATICAL PHYSICS II	Hrs/ Week : 6
Code :17PPHC21		INT :25, Ext : 75

Course Outcomes:

- 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 a Complex variables – The Derivative and the Cauchy – Riemann Differential Equations – Line Integrals of complex functions – Cauchy's integral theorem – Cauchy's integral formula – Taylor's Series.

UNIT II

Cauchy's Residue theorem – Singular points of an analytic function. The point at infinity – Evaluation of residues. Evaluation of definite integrals, Jordan's Lemma.

UNIT III

Introduction – Algebra of tensors – Quotient law – Fundamental Tensor – Cartesian tensors- Four vectors in special relativity – Covariant formulation of electrodynamics.

UNIT IV

Introduction – Definitions and Theorems of Group -Theory – The Properties of a group – some examples of groups – sub groups – Classes – Molecular Symmetry and the Symmetry Groups - General remarks – Classes of symmetry operations – Representations of groups – the Great orthogonality Theorem and its consequences – Character Tables – Representations for cyclic groups – Wave functions as bases for irreducible representations – The direct product – identifying non-zero matrix elements.

UNIT V

The Binomial Distribution – The Poisson Distribution – the Normal or Gaussian Distribution – Distribution of a sum of Normal variables – Applications to Experimental measurements – The Standard deviation of the Mean.

Text Books for Study:

1. Applied Mathematics for Engineers and physicists by Pipes and Harvill – III Edition – McGraw Hill International Book Company(1970)

   Chapter I sections 1 to 12, 14,15

   Chapter 16 Sections 9 to 16

2. Matrices and Tensors in Physics – A W.Joshi II Edition Wiley Eastern Ltd.

   Chapter 2 Sections 15 to 21.

3. Chemical applications of Group Theory by A.Cotton II Edition Wiley Eastern Ltd.

   Chapter 1 and 2, Chapter 3 Section 3.15

   Chapter 4 Sections 4.2 to 4.5.5

I M.Sc., Physics		Marks : 100
Semester II	ELECTROMAGNETIC THEORY	Hrs/ Week : 5
Code :17PPHC22		INT : 25 Ext : 75

Course Outcomes:

- 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 -Polar Dielectrics – Frequency Dependence. Anisotropy and non Homogeneity – Potential Energy of a Charge Distribution in the presence of Dielectrics – Forces on Dielectrics – Forces on Conductors in the presence of dielectrics.

UNIT II

Continuity ofV.DE. at the Interface between two different media – 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 – 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 – J.D.Jackson

3. Introduction to Electrodynamics – D.J. Griffiths

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

I M.Sc., Physics	Major Paper 8	Marks : 100
Semester II	STATISTICAL MECHANICS AND THERMODYNAMICS	Hrs/ Week : 5
Code :17PPHC23		INT : 25 Ext : 75

Course Outcomes:

- 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 – The two specific First and second law of thermodynamics and entropy – Latent heat equations – Thermodynamics potentials – The Helmholtz function and the Gibbs function – Stable and un equilibrium – Phase transitions – Third law of thermodynamics – Nernst heat Theorem- Maxwell's thermodynamical relations – Maxwell's relations from thermodynamics potentials – Two Tds equations.

UNIT II

Application of Tds equations – The Triple Point : Thompson's Theorem – gas equation – Joule Thompson's theorem The energy equation – Ratio of two S Heats – Difference of Two Specific heats – Adiabatic stretching of a wire – Application of para magnetic salts; Magneto-Caloric Effect – Thermoelectric effect – System in a field – Thermodynamics and biological systems – Application to surface I Application to chemical Thermodynamics.

UNIT III

Basic Concepts – Energy states and Energy levels – Macro states and Microstates Eigen Values, Eigen states and Eigen functions – Phase space – Thermodynamics probability – Calculation of thermodynamic probability – Relation between Entropy and Thermodynamic probability – Basic postulates of Statistical mechanics – Statistics assembly of particle (phase space, density of states and distribution function) of ensembles – Canonical ensemble – thermodynamical relations in a canonical energy – Micro canonical ensemble – Grand canonical ensemble – Liouville's theorem.

UNIT IV

Introduction – Entropy and umber of Eigen states (Sockur – Tetrode equation Thermodynamic functions (Internal energy, Enthalpy, Helmholtz free energy, function, Entropy) – Entropy and Heat capacity – Entropy and free energy – I functions for a system – Boltzmann's equation theorem – Translational I functions, Rotational partition functions, Vibrational partition functions – Calculation thermodynamic functions fo a system – MB statistics BE statistics and FD statistic

UNIT V

The mono atomic ideal gas – The distribution of molecular velocities – Specific heat capacity of a diatomic gas – The Einstein theory of the specific heat capacity of a solid – The Debye theory of the specific heat capacity of a solid – Blackbody radiation - para magnetism – The electron gas – Brownian motion

Text Books for Study:

1. Thermodynamics, Kinetic Theory and Statistical Thermodynamics by F.W.Sears and L.Salinger, Narosa Publishing House (III Edison) – Chapter 11, 12 and 13.

2. Thermodynamics and Statistical physics by Sharma and Sarkar, Himalaya Publishing House (Edition 2005) – Chapter 2, 5 and 6.

Books for Reference:

1. Thermodynamics by P.C.Rakshit, The New Book Stall, IV Eidtion (1983)

2. Statistical Mechanic by Donald A McQaurie, Viva Books Private Ltd (Edition 2003)

3. Statistical Physics by D.J.Amit and .Verbin, World Scientific publishing company (1999)

4. Statistical Mechanics and properties of Matter by E.S.R. Gopal, John Wiley and Sons (1974)

I M.Sc., Physics		Marks : 100
Semester II	PRACTICAL - II	Hrs/ Week : 8
Code : 17PPHC2P		INT : 40, Ext : 60

Practical II – First Year – II Semester – General Physics (Any Eight Experiments)

1. Error analysis and least squares
2. Refractive index of a liquid using Hollow prism
3. Cauchy's constants
4. Hyperbolic fringes
5. Elliptical fringes
6. Anderson's bridge
7. Mutual inductance using Carey Foster's bridge
8. Numerical integration
9. Wien's bridge and Owen's bridge
10. Edser – Butler fringes
11. Optic bench – Biprism experiments

12 Michelson's interferometer

I M.Sc., Physics		Marks : 100
Semester II	NANO PHYSICS	Hrs/ Week : 6
Code :17PPHE21		INT : 25 Ext : 75

Course Outcomes:

- To comprehend the principles of nanotechnology.
- To enable the student to explore the field of nanomaterials

UNIT I

Introduction - Nano and Nature – Nano particles – properties and applications of nano particles – Investigating and manipulating materials in the nano - Electron microscopes – Scanning probe microscopes – Optical microscopes for nano science and technology – Other kinds of microscopes – X-ray diffraction – Association techniques.

UNIT II

Nano powders and Nano materials - Preparation – plasma arcing – Chemical vapour deposition – Electro deposition – Chemical precipitation method – Ball million Natural nano particles – Application of Nano matters (Insulation materials, Machine tools, Phosphors, batteries, High power magnets, Motor vehicles and aircraft, Medical implants and other medical uses)

UNIT III

Optics, Photonics, Solar energy – properties of light and nano technology interaction of light and nano technology –Nano holes and photons – Imaging – New cost energy efficient windows and solar absorbers based on nano particles – Photons crystals, surface wave guides and control of light paths.

UNIT IV

Introduction to nano electronics – Birth of electronics – Semiconductors integrated circuits –Tools of micro and nano fabrication – from classical to quantum physics - Quantum electronic devices – Quantum information and quantum computer Experimental implementation of quantum computers.

UNIT V

Nano technology for future applications – Micro electro chemical systems - Ageless materials - invisible mending of atomic dislocations inside damaged materials Nano mechanics and nano elasticity – Nano particle coatings- Nano electronic magnetic devices and new computing systems – Opto electronic devices – Environmental applications.

Text Books for Study:

1. Nano the essential by T.Pradeep, McGraw Hill Company (Edition 2007) Chapters 1and 2.

2. Nano technology by M.Wilson, K.K.G.Smith, M. Simmons and B.Raguse, Overseas press (Edition 2005)

Books for Reference:

1. Nanotechnology by Richard Booker and Earl Baysen Wiley dreamtech India (P) Ltd (Edition 2005)

2. Nano Crystalline Materials – Current research and future directions – C Suryanarayanan and C.C.Koch, Hyperfine Interactions Journal (2000)

I M.Sc., Physics		Marks : 100
Semester II	MEDICAL PHYSICS	Hrs/ Week : 6
Code :17PPHE22		INT : 25, Ext : 75

Course Outcomes:

- To understand the general concepts in radiation and its interaction and dose measurements
- To apply the physics concepts in clinical trails
- To educate scientifically the principles of radiations and its effects in the medical fields

UNIT I

General properties of sound, The body as a drum (percussion in Medicine) The stethoscope. Ultrasound pictures of the body, Ultra sound to measure motion, physiological effect of ultrasound in therapy. The production of speech, physics of the ear and Hearing – the Outer ear, The middle ear, The inner ear, Sensitivity of the ears, Testing your hearing, Deafness and hearing aids

UNIT II

Measurement of light and its units, Applications of visible light in medicine, Applications of ultraviolet and infrared light in Medicine. Lasers in million, application of Microscopes in Medicine. Physics of Eye and Vision: Focusing Elements of the eye, some other elements of the eye The retina – The light detector of the eye. How sharp are your eyes? Optical illusions and related phenomena defective vision and its correction colour vision and chromatic aberration, Instruments used in ophthalmology.

UNIT III

Production of X-Ray beams, x-ray image, radiation to patients from X-rays producing live X-ray images Fluoroscopy, x-ray lices of the body, Radiographs taken without film.

UNIT IV

Physics of Nuclear medicine (Radio isotopes in Medicine) Review of basic characteristics and units of radioactive, Source of radioactive for nuclear medicine s statistical aspects of nuclear medicines. Basic instrumentation and its clinical applications Nuclear medicine making devices, Physical principles of nuclear medicine imaging procedures, Therapy with radioactivity, Radiation doses in nuclear medicine.

UNIT V

The dose units used in radio therapy – the Red and the gray, principles of radiation therapy. A short course in radio therapy treatment planning Mega voltage therapy. Short distance radio therapy or bane therapy other radiation sources, closing thought on radio therapy.

Text Books for Study:

Medical physics – John R.Chameron and James G.Skofronick, John Wiley & Sons, Jew York (1978)

II M.Sc., Physics	Major Paper 11	Marks : 100
Semester III	SOLID STATE PHYSICS - I	Hrs/ Week : 6
Code :17PPHC31		INT : 25 Ext : 75

Course Outcomes:

- 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 :

Periodic arrangements of atoms, concepts of lattice, lattice transition vectors primitive lattice cell, two and there dimensional lattice types, Miller indices of crystal planes, simple crystal structures like sodium chloride type caesium chloride type, hexagonal and face centered close packed structures, diamond structure and cubic zinc sulphide structure. Diffraction of waves by Crystals: Bragg's law, Reciprocal lattice to scc bcc and fcc lattices: Fourier analysis of e basis and structure factors of bcc and fcc lattices.

UNIT II

Crystal Binding and elastic constant inert gas crystals, ionic covalent and metallic crystals. Hydrogen bonds, atomic radii, Analysis of elastic strains, elastic stiffens and compliance constants. Elastic wave in cubic crystals.

UNIT III

Vibrant ions of linear monoatomic and diatomic chains, quantization of elastic waves honon momentum-Plank distribution for a system of identical harmonic oscillators, periodic boundaries conditions and density of states in one and two dimension, Einstein and Deby's theories of specific heat-Anhormonicity of lattice vibrations, thermal expansion, Thermal conductivity and Umklapp processes.

UNIT IV

Energy levels in one dimension Fermi Dirac distribution for a free electro gas. Periodic boundary condition and free electron gas in three dimension. Heat capacity of the electro gas. Ohm's law , Matthiessen's rule and Umklapp process. Hall effect- Weidmen – Franz law, Nearly free electron model, and the origin and magnetic of the energy gap. Block functions, Motion of an electron in a periodic potential Kronig Penny Model. Block theorem Approximate solution near a zone boundary.

UNIT V

Band gap in semiconductors. Equations of motion, holes and effective mass. Intrinsic mobility, Donor and acceptor states and thermal ionisation donors and acceptors. Reduced and periodic zone schemes. Construction of Fermi surfaces. Electron orbits Tight – binding method for energy bands, Wigner – Seitz method and cohesive energy. Quantization of orbits in a magnetic field. De Hass-van Aplhen effect.

Text Books for Study:

1. Introduction to Solid state physics – Charles Kittel – ViII eidtion Chpaters 1 to 9

Books for reference:

1. Principles of the Theory of Solids – J.M.Zinam – II Edition (Cambridge 1972)]

2. Solid state Physics – N.W.Aschorft and N.D.Mermin – Hot, Rineharet and Winstrton (1976)

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

4. Sold State Physics – S.O.Pillai – New Age publications (1979)

II M.Sc., Physics		Marks : 100
Semester III	QUANTUM MECHANICS - I	Hrs/ Week : 5
Code :17PPHC32		INT : 25, Ext : 75

Course Outcomes:

- 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 :

Black body radiation – Planck's quantum hypothesis -Specific heats of solids – de Broglie hypotheses – the motion of a free wave packet – Uncertainties introduced in the processes of measurements – Diffraction phenomena – interpretation of the wave packet dualism – Complementarities – The Formulation of quantum mechanics.

UNIT II

A free particle in one dimension generalisation to three dimension – The operator correspondence and the Schrödinger equation for a particle subject to forces - Normalisation and Probability interpretation non-normalizable wave function and box normalisation – Conservation of probability – Expectation values; Ehrenfest's Theorem – Admissibility conditions on the wave functions – Stationary states The time independent Schrödinger equation– A particle in a square well positional – Bound states in a square well (E>O) – The square well: Non localize states (E>O) Square potential Barrier.

UNIT III

The fundamental postulates of wave mechanics – the adjoint of an operator and self adjointness – The eigen value problem; degeneracy – Eigen values and Eigen functions of self adjoin operators – Dirac Delta function – Observable : Completeness and normalization of Eigen functions – Closure – physical interpretation of Eigen functions. Eigen values and expansion coefficients – momentum Eigen functions Wave function in momentum space – The uncertainty principle – States with minimum value for uncertainty product – Commuting observable; removal of degeneracy – Evolution of system with time constants of motion – non-interacting and interacting system – systems of identical particles.

UNIT IV

The Schrodinger Equation and energy Eigen values – the Energy Eigen functions, properties of Stationary states The abstract operator method - The angular momentum operators the Eigen value equation I separation of variable admissibility conditions of solutions Eigen values – The Eigen functions spherical harmonics physical interpretation – parity Angular momentum in stationary sets of systems with spherical symmetry – Salt in the interior region solution in the exterior region and Matching- Solution of the Radial equation; Energy level – Stationary state wave functions discussion of bound states.

UNIT V

Approximation methods for state binary states: Equations in various orders of Perturbation theory – The non degenerate case – The degenerate case – Removal of degeneracy - The effect of an Electric field on the level of an at om (Stark effect) Two electron atoms – Upper bound on ground state energy – Application to excited states Trial function linear in variational parameters – The Hydrogen molecule - Exchange interaction – The one dimensional Schrodinger equation – The Bohr – Sommerfeld Quantum Condition.

Text Books for Study:

1. A text book of Quantum Mechanics – P.M.Matheward K.Venkatesan T.M.H. Publishing company ltd.

Chapters 1,2,3, 4,5 Relevant sections.

***Books for reference*:**

1. Quantum Mechanics – L.I.Schiff - III Edition.
2. Quantum Mechaincs – E.Merzhacker
3. Quantum Mechanics – JL.Powell andcarssaman
4. Quantum Mechanics – Schwabl – Narosa publcations
5. Quantum Mechanics – B.K.Agarawal and Hariprakash – PHI (1997)

II M.Sc., Physics		Marks : 100
Semester III	PRACTICAL - III	Hrs/ Week : 8
Code :17PPHC33		INT : 60, Ext : 40

Practical III – Second Year – III Semester – Electronics (Any Eight Experiments)

1. Universal NAND and NOR gates
2. Verification of De Morgan's theorem ad Boolean Functions
3. Active Filters – Low, high and band pass filters
4. IC 555 Timer – Square wave generation
5. Solving simultaneous equations (Two variables only) using IC 741
6. JK flip-flop – Up and Down counters
7. Half adder and full adder circuits using ICs
8. Optimisation of Boolean functions – Karnaugh Map method
9. Notch filter using IC and study of its characteristics.
10. Microprocessor based experiments – Addition, subtraction and multiplication
11. Study of Wide band amplifier
12. Ring counter

II M.Sc., Physics		Marks : 100
Semester III	APPLIED OPTICS AND LASER PHYSICS	Hrs/ Week : 5
Code :17PPHE31		INT : 25, Ext : 75

Course Outcomes :

- To develop the knowledge in the basics and principles of laser
- To explore the control of laser properties

UNIT I:

Matrix method in Gaussian Optics –refraction and translation matrices- image formation process - Combination of image forming systems – Matrix representation on polarisation – Jones calculus Anisotropic medium – interference by reflections from non-identical interfaces – interferences by multiple reflections.

UNIT II

Fourier optics – Scalar diffraction theory – Kirchhoff's formulation of diffraction pattern by a plane screen – Fresnel and Fraunhoffer diffraction pattern – Fourier transformation and imaging properties of lenses – Thin lenses and a phase transformation – - F T properties of lenses – Spatial filtering – Introduction of Fourier optics frequency – Domain synthesis – The Vander Lugt Filler – Concept of Spatial and temporal coherence.

UNIT III

Frequency analysis of imaging system of- Frequency response of a diffraction - Limited coherence imaging system- Coherent transfer functions – Frequency response of a diffraction limited in coherent – Imaging system.

UNIT IV

Non-linear optics – Harmonic generations - Second harmonic generation and phase matching – optical mixing parametric generation of light-self focussing of light.

UNIT V

Laser – Introduction Stimulated emission and thermal radiation, amplification in medium, methods of producing population inversion. Laser oscillation, optical resonator theory, gas lasers, optically pumped solid state lasers, dye lasers Semiconductor diode lasers, Q switching and mode locking.

Text Books for Study:

1. Introduction to Fourier Optics – J.W.Goodman
2. Lasers and Non linear optic – B.B.Laud (Wiley eastern)

***Books for reference*:**

1. Optics – M.V. Klein and T.E.Furtak, (John Wiley, 1986)
2. Introduction of Modern optics by G.R.Fowles

   (Holt Rinchart and Winston Inc)
3. Introduction to optics – F.L.Pedrolt (Prentice Hall of India)
4. Optical Electronics- A. Ghatak and K.Thyagarajan (Cambridge University Press, 1991)

II M.Sc., Physics		Marks : 100
Semester III	COMPUTER PROGRAMMING IN C++	Hrs/ Week : 6
Code : 17PPHE32		INT : 25, Ext : 75

Course Outcomes :

- To develop the programming skills
- To study the numerical algorithms and their implementation to solve problems

UNIT I :

Introduction to object oriented programming with C++ basic concepts – Structure - character set – identifiers and key words – Constants – C++ operators – Type conversion Declaration of variable – Statements- Simple C++ programs – Feature of io stream. h – Manipulators functions – Input and output (I/O) stream flags – Conditional Expressions - switch statement – Loop statements- Breaking Control statements.

UNIT II

Defining a function – Return statement – types of functions – Actual and Formal Arguments – Local and Global variables – Default arguments – Multi function program - Storage Class specifiers – Recursive Function – pre processors – Header Files – Standard Functions; Array Notation – Array Declaration – Array Initialization – Processing with Array - Array and Functions – Multi Dimensional Arrays – Character Array – Simple programme

UNIT III

Pointer Declaration - Pointer Arithmetic – Pointers and Functions – Pointers and Arrays – Pointers and Strings – Arrays of Pointers – Pointer to pointers – Declaration of Structure – Initialization of Structure – Functions and Structure.

UNIT IV

Arrays of structures – Arrays within a structures – Structures within a Structure (Nested Structure) - Pointers and Structures – Unions – Type definition - Enumerations - Structures and Classes – Declaration of class – member functions. Defining the Object of a Class – Array of Class Object – Pointers and Classes – Unions and Classes – Classes within Classes (Nested Classes) - Simple programs.

UNIT V

Introduction – Single heritance – Ambiguity in Single heritance – Array of class objects and single heritance – Multiple heritance – Member access control function overloading - Operator Overloading – Over loading of Binary operators and unary Operator. Data File operations – Opening and closing a file – Reading / writing a character from a file - Structures and file operations – Classes and file operations – arrays and file operations – Nested classes and file operation – Random access file processing.

Text Books for Study:

1. Programming with C++ by D.Ravichandran

   Tata McGraw – Hill publishing Company Limited New Delhi (1996)

   Unit I – Chapters 1,2 and 3

   Unit II - Chapters 4, 5 an 6

   Unit III – Chapters 7 (Secs 7.1 to 7.8, 7.9, 7.10 and 8

***Books for reference*:**

1. Programming in C++ by E. Balagurusamy
2. Let us C++ by Yashwant Kanetkar, BPB Publication.
3. Programming in C++ by P.Radhaganesan, Scitech Publication (India)
4. Programming with C++ Schaum Series

II M.Sc., Physics		Marks : 100
Semester III	MICROPROCESSORS	Hrs/ Week : 6
Code :17PPHN31		INT : 25, Ext : 75

Course Outcomes :

- 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 write, 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 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 – III Edition by Ramesh Gaonkar (Penram International Publishing, India, 1997)

Unit – I Sec. 3.1 to 3.5; 5.1 to 5.5; 6.1 to 6.6

Unit – II Sec. 7.1 to 7.6

Unit – III Sec. 8.1 to 8.5; 9.1 to 9.4

Unit – IV Sec.10.1 to 10.9; 12.1 to 12.3

Unit – V Sec. 13.1 to 13.2; 15.1

***Books for reference*:**

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

2. Microprocessors by A.P.Godse and D.A. Godse, Technical Publication (Edition 2005), Pune.

3. Introduction to Microprocessors by A.P.Mathur (II) Edition) Tata McGraw Hilll Company, New Delhi.

II M.Sc., Physics		Marks : 100
Semester IV	SOLID STATE PHYSICS II	Hrs/ Week : 6
Code :17PPHC41		INT : 25, Ext : 75

Course Outcomes :

- 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 :

Dielectric function of the electron gas, longitudinal plasma oscillations, Plasmons, electrostatic screenings screened coulomb potential Mott transitions, screening and Phonons in metals, Polarising and LST relation, Electron – Electron interaction, electron- phonon, interaction and polarons, Peierls instability, Kramers,- Kronig dispersion relations, Frenkel and Mott-Wannier excitons. Exciton condensation, Raman Effect in crystals.

UNIT II

Superconductivity: Its occurrence and its destruction by magnetic fields, meissner effect. Heat Capacity, energy gap, microwave and infra red properties and isotope effect. Stabilisation energy of a superconductor, London theory of Meissner effect, coherence length, Basic ideas of BCS theory, Flux quantization. Type II Superconductors and vortex state. Single particle tunnelling DC and AC Josephson effects. Microscopic quantum interference. High Temperature conducting (HTC) materials. Relation. Various types of polarizability. Ferro Electricity; its occurrence and classification. Soft optical phonon. Landau theory of phase transitions; first and second orders.

UNIT III

Langevin diamagnetism equation and quantum theory of diamagnetism, Quantum theory of paramagntism. Hund's rules. Crystal splitting factor Van Vleck Temperature independent para magnetism. Ferro magnetism Curie Point, Weiss molecular field theory. Saturation magnetization. Quantization of spin waves (magnons) and thermal excitation of magnons. Ferromagnetism and anti ferromagnetism. Neel temperature. Ferromagnetic domain walls and origin of domains – Coercivity and hysteresis.

UNIT IV

Nuclear magnetic Resonance: Bloch equations and power absorption Motional narrowing Electron paramagnetic resonance and paramagnetic defects point defects: Schottky defects. Frenkel defects. Diffusion in metals. F centers.

UNIT V

Reconstruction and relaxation, surface crystallography. Work function, thermionic emission, surface states and tangential surface transport. Quantum Hall effects: IQHF and FQHE. P-n junctions; rectifications, solar cells and photovoltaic detectors. Phenomenon of slip. Edge and Screw dislocations, Burgers vectors. Stress Fields of dislocations. Strength of alloys. Substitutional solid solutions – Hume – Rothery rules. Elementary theory of order. Kondo effect.

Text Books for Study:

Introduction to solid state physics (VII edition) (1995) by C.Kittel, John Wiley & Sons – Chapters. 10 to 16, 18 to 21.

***Books for reference*:**

1. Principles of the Theory of Solids – J.M.Ziman – II Edition.(Cambridge 1972)

2. Solid state physics – N.W.Aschroft and N.D.Mermin – Holt, Rinehart and Winston (1976)

II M.Sc., Physics		Marks : 100
Semester IV	QUANTUM MECHANICS - II	Hrs/ Week : 5
Code : 17PPHC42		INT : 25, Ext : 75

Course Outcomes :

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

UNIT I :

General considerations - Kinematics of the Scattering Process: Differential and Total Cross Sections - Wave technical picture of scattering : The Scattering amplitude – Green's Functions; Formal expression for scattering amplitude. The Born and Eikonal approximations; The Born approximation – Validity of the Born approximation – The Born series – The Eikonal approximation partial wave analysis: Asymptotic behaviour of partial waves: Phase Shifts – The scattering amplitude in terms of phase shifts – the differential and Total Cross Sections – Phase Shifts relation to the potential – Low energy scattering, Exactly soluble problems: Scattering by a square well potential – Scattering by a Hard Sphere – Scattering by a coulomb potential.

UNIT II

Quantum Sates - State Vectors and Wave Functions – The Hilbert Space of Sate vectors; Dirac notation – Dynamical variables and linear operators – Representations – continuous basis – The Schrodinger representation – Degeneracy, Labelling by commuting observables – Change of basis; Unitary transformations –Unitary transformations induced by change of coordinate systems: Translations – Unitary Transformation induced by rotation of coordinate system – The algebra of rotation generators – Transformation of dynamical variable – Symmetries and conservations laws inversion – Time reversal.

UNIT III

The eigen value spectrum – Matrix representation of J in the im> Basis – Spin Angular Momentum – Non relativistic Hamiltonian including spin – addition of Angular Momenta – Clebsch-Gordan Coeffcients – Spin Wave Functions for System of Two Spin – ½ particles – identical particles with spin.

UNIT IV

Perturbation theory for time Evolution problems: perturbative solution for transition amplitude - Selection Rules – First Order Transitions: constant perturbation – Transitions in the second order; Constant perturbation – Scattering of particle by a potential – The Schrodinger Picture, The Heisenberg Picture. The interaction Picture – Harmonic perturbations – Interaction of an Atom with electromagnetic Radiation – The Dipole Approximation: Selection Rules – The Einstein Coefficients: Spontaneous Emission.

UNIT V

The Klein –Gordon Equation: Plane wave solutions: charge and Current Densities – interaction with Electromagnetic Fields; Hydrogen like atom – Non relativistic limit. The Dirac equation : Dirac Relativistic Hamilton – Position probability Density; Expectation values – Dirac matrices – Plane wave solutions of the Dirac equation; energy spectrum – The Spin of the Dirac particle – Significance of negative Energy Sates; Dirac Particle in Electromagnetic Fields – Relativistic Electron in Central Potential: Total Angular Momentum.

Text Books for Study:

A text book of Quantum Mechanics - P.M. Mathew & K.Venkatesan – TMH pub. Com. Ltd. New Delhi (1993)

Unit I Chap (6) Secs 6.1 to 6.5, 6.8 to 6.11 and 6.11 to 6.16

Unit II Chap (7) Secs. 7.1 to 7.14

Unit III Chap (8) Secs. 8.1 to 8.8

Unit IV Chap (9) 9.5 to 9.15, 9.16, 9.17 and 9.21

Unit V Chap (10) Secs. 10.1 to 10.11

***Books for reference*:**

1. Quantum Mechanics – L.ISchiff – III edition.
2. Quantum Mechanics – E.Merzbacher
3. Quantum Mechanics – Ghatak and Loganathan
4. Quantum Mechanics – A.S. Davydov

II M.Sc., Physics		Marks : 100
Semester IV	NUCLEAR AND PARTICLE PHYSICS	Hrs/ Week : 5
Code : 17PPHC43		INT : 25, Ext : 75

Course Outcomes :

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

UNIT I

Introduction, Interaction between particles and matter, Detectors for Nuclear particles – A Brief Survey.

The Q Equation: Introduction. Types of Nuclear Reaction. The Balance of Mass and Energy in Nuclear Reactions. The Q Equation, Solution of the Q Equation. Centre of Mass Frame in Nuclear Physics.

UNIT II

Constituents of the Nucleus and some of their properties Introduction. Rutherford scattering and Estimation of the Nuclear size. Measurement of Nucleus Radius Constituents of the Nucleus and their Properties. Nuclears in Moments and statistics.

Alpha Rays : Range of α – particles, Disintegration Energy of Spontaneous α-Decay. Alpha Decay Paradox – Barrier penetration.

Beta Rays: Introduction. Continuous beta – ray spectrum – Difficulties Encounter to understand it. Paulis Neutrino Hypothesis, Fermi's Theory of Beta Decay. The detection of Neturino.Parity Non-Conservation Beta Decay.

Introduction to Gamma Emission: Introduction. Gamma-ray emission – Selection Rules, Internal conversion, Nuclear Isomerism.

UNIT III

The liquid drop Model of Nucleus : Introduction, Binding Energise of Nuclei; Plot of B/A against A. Weizsacher's Semi-empirical Mass Formula. Mass parabolas: Prediction of Stability against β-decay for Members of an Isobaric Family Stability Limits Against Spontaneous Fission, Barrier penetration – Decay probabilities for Spontaneous Fission, Nucleon emission.

Nuclear Energy: Introduction. Neutron induced Fission, Asymmetrical Fission - Mass Yield. Emission of Delayed Neutrons by Fission Fragments, Energy Released in the Fission of ^{235}U, Fission of Lighter Nuclei, Fission Chain Reaction. Neutro Cycle in a Thermal Nuclear Reactor, Nuclear Reactors.

UNIT IV

The Shell Model of Nucleus: Instruction. The Evidence that led to the Shell Model. Main Assumptions of the Single-particle Shell model. Spin-orbit coupling of an Electron Bond in an Atom, Spin-Orbit. Coupling in Nuclei for a single particle Shell Model. The

Single-Model – Parabolic Potential, The Single-Particle Shell Model – Square well potential, prediction of the Shell Model. The Collective Model of a Nucleus.

Introduction. The Ground State of the Deuteron. Magnetic Dipole and Electric Quadrapole Moments of the Deuteron, Square Well solution for the Deuteron. Central and Non-Central Forces: The Tensor Forces as an example of Non-Central Forces Exchange Forces: Meson Theory of Nuclear Force – A Qualitative Discussion, Qualitative Features of the Nucleon – Nucleon Scattering.

Unit V

Sub-nuclear physics: Particle classification, the particle Directory. Leptons and Quarks : The Fundamental particles , the Fundamental interactions , The Electormagnectic coupling. The Strong Coupling. The Weak Coupling. Vacuum Polarization. Towards a Unification of the Fundamental Interactions.

Symmetry Transformation and Conservation Laws : Charge Conjugation. Time reversal. The CPT Theorem. G-Parity. The Electromagnetic Field : Gauge invariance and Maxwell's equations, polarisation and photon spin, Angular momentum, parity and C-parity of the Photon.

Text Books for Study:

1. Nuclear Physics – An Introduction S.B.Patel – New Age International (P) Limited (Reprint 2003)

2. Nuclear and Particle Physics. W.E.Burcham. M.Jobes – A print of Addison Wesely Longman. Inc.(First Reprint 1998)

Portions from Book (1)

Unit I : Chapter 1 (page 1 to 24 only) and 3

Unit II : Chapter 4

Unit III : Chapter 5 and 6

Unit IV : Chapter 7 (page 236 to 260 only) and 8

Portions from book (2)

Unit V : Chapter 7 & 8 (Sec.8.8 to 8.12 only)

Books for Reference:

1. Concepts of Nuclear physics – Bernard I. Coben – TATA McGraw –Hill. New Delhi.(2004)

2. Nuclear Physics (Theory and experiment) – R.R. Roy and B.P. Nigam – Willey Eastern Ltd.(1986)

3. Modern Atomic ad Nuclear physics – Fuji Yang and Joseph H.Hamilton – McGraw Hill International Edition (1996)

II M.Sc., Physics		Marks : 100
Semester IV	PRACTICAL - IV	Hrs/ Week : 8
Code : 17PPHC4P		INT : 40, Ext : 60

Practical IV – Second Year – IV Semester – General Physics (Any Eight Experiments)

1. Study of Susceptibility measurements – Guoy balance method
2. Study of Susceptibility measurements – Quincke's method
3. Hall effect
4. Dielectric parameters of a given liquid
5. Ultrasonic study of liquid
6. Refractive index of a liquid using Laser Light
7. Laser based diffraction experiments
8. Experiments using fibre optics kit
9. Arc spectrum – constant deviation spectrograph
10. Refractive index of a liquid using Newton's rings
11. Infra red spectral analysis
12. Ultra violet spectral analysis

II M.Sc., Physics		Marks : 100
Semester IV	PROJECT	Hrs/ Week : 6
Code :17PPHE41		INT : 25, Ext : 75

II M.Sc., Physics		Marks : 100
Semester IV	MOLECULAR SPECTROSCOPY	Hrs/ Week : 6
Code : 17PPHE42		INT : 25, Ext : 75

Course Outcomes :

- To emphasize the modern developments in experimental techniques especially spectroscopy.
- Appreciate the physical process involved in the working of the equipments.

UNIT I

Microwave spectroscopy: Introduction. Experimental method, information derived from work on gases, applications.

UNIT II

Infrared Spectroscopy : Introduction. pure rotational spectra. Molecular vibrations. Absorption of energy in the infrared. Vibration – rotation spectra of diatomic and polyatomic molecules, infrared spectra of compressed gases and violation of selection rules. Infrared spectra of liquids, solids and solutions, applications.

UNIT III

Raman spectroscopy experimental, classical theory poly and selection rules. Quantum theory, pure rotational – Raman spectroscopy of diatomic and ploy atomic molecules. Vibrational Raman spectra, applications, correlation of infrared and Raman spectra.

UNIT IV

Electronic spectra of molecules : Born Openheimer approximation. vibrational structure – Franck – Condon Principle, dissociation – rotational structure- predissociation.

UNIT V

Spin – resonance spectroscopy: Spin and applied field. NMR of hydrogen and other Nuclei, ESR, experimental methods.

Text Books for Study:

1. Spectroscopy, Vol.2 Edited by B.P.Staughan and S.Walker, Chopman& Hall. Chap.3.1 to 3.3, 4.1 to 4.20
2. Molecular Spectroscopy by C.N.Banwell, Chap 6.1, 7.1 to 7.5
3. Chemical Applications of group theory - F Albert Cotton (II Edition) Wiley Eastern Ltd.