of the Academic Council
held on 23.06.2008

APPENDIX – A

MADURAI KAMARAJ UNIVERSITY

(University with Potential for Excellence)

M.Sc. Br.III (a) Physics: Revised Syllabus under CBCS

Scheme of Examinations

(To be effective for those who join from July 2008 onwards)

No.	Title of the paper	Sub. Code	Credits	Exam hrs.	Marks Int.	Marks Ext.	Total
	Semester I						
1	Mathematical Physics – I		5	3	25	75	100
2	Classical Mechanics		4	3	25	75	100
3	Applied Electronics		4	3	25	75	100
4	Major Elective Computer Oriented Numerical Methods		5	3	25	75	100
	Semester II						
6	Mathematical Physics – II		5	3	25	75	100
7	Electromagnetic theory		4	3	25	75	100
8	Statistical Mechanics and Thermodynamics		4	3	25	75	100
9	Practical II – General Physics		5	4	40	60	100
10	Major Elective Nano Physics / Medical Physics		5	3	25	75	100
	Semester III						
11	Solid State Physics – I		4	3	25	75	100
12	Quantum Mechanics – I		4	3	25	75	100
13	Applied Optics and Laser Physics		4	3	25	75	100
14	Practical III – Electronics		5	4	40	60	100
15	Non – Major Elective Microprocessors / Computer Programming in C++		5	3	25	75	100

PRINCIPAL
Arulmigu Palaniandavar College
of Arts & Culture,
PALANI - 624 601.

	Semester IV					
16	Solid State Physics – II	4	3	25	75	100
17	Quantum Mechanics – II	4	3	25	75	100
18	Nuclear and Particle Physics	4	3	25	75	100
19	Practical IV - General Physics	5	4	40	60	100
20	Major Elective- Project / Molecular Spectroscopy / Fibre optics Communications	5	3	25	75	100
	Total	90				2000

I M.Sc., Physics	Major Paper-I	Marks : 100
Semester I	MATHEMATICAL PHYSICS –I	Hrs/week : 6
Code: EP18C11		INT:25, Ext:75

UNIT I

Matrices and Vectors:

Vector Spaces and transformations – The Algebra of 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 applications of the operator ∇– Orthogonal curvilinear coordinates -Applicatron to hydrodynamics – Equation of heat flow in solids.

UNIT II

Fourier series, Fourier Integrals & Fourier Transforms:

Taylor's Series – Symbolic form of Taylor's series – Evaluation of integrals by means of Power Series – Fourier Series and Integrals – Representation of More complicated Periodic phenomena : 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 – Some applications of Fourier Transform.

UNIT III

Special Functions I:

Bessel's Differential Equation – Series solution of Bessel's Differential Equation. The 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 J_n (x) when n is half and odd integer Differential Equations Whose solutions are expressible in terms of Bessel Functions – Modified Bessel Functions Expansion in series of Bessel Functions – The Bessel Coefficients

UNIT IV

Special Functions II:

Legendre's Differential Equation – Rodrigue's formula for the Legendre Polynomials – Legendre's function of the second kind – The Generating function for P_n (x) – The Legendre coefficients – The Orthogonality of P_n (x) –Expansion in series of Legendre polynomials – The Gamma Function – The Factorial Gauss's Pi Function – The Value of (1, 2) Graph of the Gamma Function – The Beta Function – The Connection of the Beta Function and the Gamma Function.

UNIT V

Special Functions III:

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

Text Books for Study:

1. 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.

2. Mathematics physics – Sathya Prakash (Revised Edition 2002)
   Chapter 6: Sections 6.29 – 6.43.

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

Books for reference:

1. Mathematical Physics – Eugene Butkov – Addison – Wesley Publishing Company.
2. Mathematical Physics for Physicists – George B.Arfken and Hans J.Weber – Fourth Edition – Prism Books Pvt. Ltd., Bangalore (1994).
3. Mathematical Physics – B.D.Gupta. Third Edition 2005 (Vikas Publishing house Private Ltd. New Delhi).
4. Mathematical Physics – H.K.Dass. Fourth Edition 2004 (S.Chand & Company Ltd. New Delhi).

I M.Sc., Physics	Major Paper-2	Marks : 100
Semester I		Hrs/week : 6
Code: EPH8C12	CLASSICAL MECHANICS	INT: 25, Ext: 75

UNIT – I Lagrangian and Hamiltonian Methods

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 Central field motion

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 Canonical Transformations

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 Small oscillations

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 Theory

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 Book for Study :

Classical Mechanics – Goldstein II Edn. (1980) Addison Wesley, World student Edn

Chapter: *3.6, 8.9.10 relevant sections.*

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*

I M.Sc., Physics	Major Paper-3	Marks : 100
Semester I		Hrs/weeks: 6
Code: [illegible]3	APPLIED ELECTRONICS	INT:25, Ext:75

UNIT – I

Communication systems: 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 carrier. Suppression of Sideband, Extensions of SSB.

UNIT – II

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

UNIT – III

Pulse Modulation: Types 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

Semiconductor devices: FET UJT small signal model – MOSFET – Common source amplifier – Source follower – Generalized FET amplifier – Biasing the FET – FET as 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 detecior mounts. T-junctions Magic eye and its applications.

UNIT – V

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

Text Books for Study:

1. *Electronic Devices and Circuits – Millman & Halkias, McGraw Hill International Book Company.*
2. *Electronics Communication System – George Kennedy III edition – Mc Graw Hill Company.*

Books for reference:

1. *Integrated Electronics – Millman & Halkias, Tata McGraw Hill Company.*
2. *Digital Logic and Computer Design – M. Morris Mano, Prentice Hall of India.*

I M.Sc., Physics	Major Paper – 4	Marks : 100
Semester I	Practical – I	Hrs/week : 6
Code: EPH8C1P		INT:40, Ext:60

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

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

I M.Sc., Physics	Major Elective: Paper – 5	Marks : 100
Semester I	COMPUTER ORIENTED NUMERICAL METHODS	Hrs/week : 6
Code: EPH8T11		INT:25, Ext:75

UNIT – I

Iterative Methods: Introduction – Beginning an iterative method – The metho Successive bisection – Newton Raphson iterative method – The secant method – method of successive approximations – comparison of iterative methods.

UNIT – II

Solution of simultaneous Algebraic Equations: Introduction – The G Elimination method – Pivoting – Ill conditioned equations. Refinement of the solu obtained by Gaussian elimination – The Gauss-Seidal iterative method – An algorithn implement the Gauss-Seidal method – comparison of direct and iterative methods.

UNIT – III

Interpolation: Lagrange interpolation – difference tables – Truncation erro interpolation-Least squares approximation of functions – Linear regression – Algori for linear regression.

UNIT – IV

Differentiation and integration: Formulae for numerical integration – Simps rule – Gaussian quadrature formulae - Numerical solution of Differential Equatio Higher order differential equations.

UNIT – V

Application to specific problems: Programs for 1.solution of an equation iterative method (Newton Raphson method). 2. Solution of simultaneous equations Calculation of mean and variance. 4. Calculation of correlation Coefficients – Li regressions. 5. Solution of first order differential equation (Runge – Kutta metho Solution of II order differential equation (Runge-Kutta method) 7. Evaluation of def integrals (Trapezoidal and Simpson rule) 8. Evaluation on inverse of a matri Evaluation of matrix polynomial.
(Programs 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 de Boor, Third Edition –McGraw Hill International Company (1983)*
2. *Numerical Methods for Engineers – Steven C.Chopra, Raymond 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 Paper-6	Marks : 100
Semester II	MATHEMATICAL PHYSICS II	Hrs/week : 6
Code: EPH8C2		INT:25, Ext:75

UNIT –I

Complex Variables: Introduction – Functions of a Complex Variable – 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

Residues: 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

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

UNIT – IV

Group Theory: Introduction – Definitions and Theorems of Group Theory – Th Properties of a group – Some examples of groups – Sub groups – Classes – Molecul Symmetry and the Symmetry Groups – General remarks – Classes of symmetr operations – Representations of groups – The Great orthogonally Theorem and it consequences – Character Tables – Representations for cyclic groups – Wave functions a bases for irreducible representations – The direct product – identifying non-zero matri elements.

UNIT – V

Probability : 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 – Mc Graw Hill International Book Company (1970)
   Chapter 1 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

Books for reference:

1. Mathematics physics – Eugene Butkov – Addison – Wesley Publishing Company.
2. Mathematical Physics for Physicists – George B.Arfken and Hans J.Weber – Fourth Edition – Prism Books Pvt. Ltd., Bangalore (1994).
3. Mathematical Physics – B.D.Gupta. Third Edition 2005 (Vikas Publishing house Private Ltd. New Delhi).
4. Mathematical Physics – H.K.Dass, Fourth Edition 2004 (S.Chand & Company Ltd. New Delhi).
5. Advanced Engineering Mathematics – Erwin Kreyszig-V Edition – New Age International (P) Ltd. New Delhi – 1996.

I M.Sc., Physics	Major Paper- 7	Marks : 100
Semester II	ELECTROMAGNETIC THEORY	Hrs/week : 6
Code: EPH8522		INT:25, Ext:75

UNIT – I

Electrostatic Fields I: Electrostatic Fields 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 Quadruple – 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

Electrostatic Fields III: Continuity of V, D, E 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 a point charge moving in a 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

Magnetic Fields: The Faraday Induction Law – The Induced Electric Field Intensity E in terms of the Vector Potential A – Induced Electromotance 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 Equations.

UNIT – IV

Propagation of Electromagnetic waves: Plane wave in 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 nonconductors – Propagation of plane electromagnetic waves in Good conductors.

UNIT – V

Guided Electromagnetic waves: Propagation in a straight line – The coaxial lin The hollow rectangular wave guide radiation of electromagnetic waves. Electric Dip Radiation: The Scalar Potential – The Vector Potential A and the magnetic field inten – The Electric Field Intensity E – The Average Poynting vector and the radiated powe The Electric and Magnetic lines of force – The K surface.

Text Books for Study:

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

Unit – I: Chap (2) Secs. 2.6 to 2.11 Chap (3) 3.1 to3.13

Unit – II: Chap (4) Sec 4.1, 4.2, 4.4, 4.5 Chap (7) Secs 7.1 to 7.7

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

Unit – IV: Chap (11) Secs. 11.1 to 11.5

Unit – V: Chap (13) Secs. 13.1 to 13.3 Chap (14) Sec. 14.1.1 to 14.1.6

Books for reference:

1. Fundamentals of Electromagnetic Theory by JohnR.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 : 6
Code: EPH8C23		INT:25,Ext:75

UNIT – I Thermodynamics

First law of thermodynamics and internal energy - The Two specific heats - Second law of thermodynamics and entropy – Latent heat equations - Thermodynamic potentials – The Helmholtz function and the Gibbs function – Stable and Unstable equilibrium – Phase transitions – Third law of thermodynamics – Nernst heat theorem - Maxwell's thermodynamical relations - Maxwell's relations from thermodynamic potentials - Two Tds equations.

UNIT – II Applications of laws of thermodynamics

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

UNIT – III Statistical mechanics

Basic Concepts – Energy states and Energy levels – Macrostates and Microstates – Eigen values, Eigen states and Eigen functions – Phase space – Thermodynamic Probability – Calculation of thermodynamic probability – Relation between entropy and Thermodynamic probability - Basic postulates of Statistical mechanics – Statistics of assembly of particles (Phase space, density of states and distribution function) – Concept of ensembles – Canonical ensemble – thermodynamical relations in a canonical ensemble – Micro canonical ensemble – Grand canonical ensemble - Liouville's theorem.

UNIT – IV Statistical thermodynamics

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

(T-1)

UNIT – V Applications of Classical and Quantum statistics

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 solid – The Debye theory of the specific heat capacity of a solid – Blackbody radiation – Paramagnetism – The electron gas - Brownian motion.

Text books for study:

1. Thermodynamics, Kinetic Theory and Statistical Thermodynamics by F.W. Sears and G.L.Salinger, Narosa Publishing House (III Edition) – 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 Edition (1983).
2. Statistical Mechanics by Donald A McQuarrie, Viva Books Private Ltd (Edition 2003)
3. Statistical Physics by D.J.Amit and Y.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	Major Paper – 9	Marks : 100
Semester II	Practical – II	Hrs/week : 6
Code: EPU8C2P		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. Elliptic 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	Major Elective - Paper-10(a)	Marks : 100
Semester II	Nano Physics	Hrs/week : 6
Code: EPH8T21		INT: 25, Ext: 75

UNIT I

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

UNIT II

Nano powders and Nano materials – Preparation – Plasma arcing – Chemical Vapour deposition – Electro deposition – Chemical precipitation method – Ball milling – Natural nano particles – Applications of Nano materials(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 low cost energy efficient windows and solar absorbers based on nano particles – Photonic crystals, surface wave guides and control of light paths.

UNIT IV

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

UNIT V

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

Books for study:

1. Nano The essentials by T.Pradeep, McGraw Hill Company (Edition 2007) Chapters 1 and 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. Suryanarayananan and C.C.Koch, Hyperfine Interactions Journal (2000).

I M.Sc.,Physics	Major Elective - Paper-10(b)	Marks : 100
Semester II	Medical Physics	Hrs/week : 6
Code:		INT:25,Ext:75

Unit I

Sound in Medicine: General properties of Sound, The body as a drum (Percussion in Medicine), The stethoscope, Ultrasound pictures of the body, Ultrasound to measure motion, Physiological effects 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

Light in Medicine: Measurement of light and its units, Applications of visible light in Medicine , Applications of ultraviolet and infrared light in medicine, Lasers in medicine, Applications 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, Color vision and chromatic aberration, Instruments used in ophthalmology.

Unit III

Physics of diagnostic X-rays: Production of X-ray beams, How X-ray are absorbed, Making an X-ray image, Radiation to patients from X-rays, Producing live X-ray images – Fluoroscopy, X-ray slices of the body, Radiographs taken without film.

Unit IV

Physics of Nuclear Medicine (Radio isotopes in Medicine): Review of basic characteristics and units of radioactivity, Sources of radioactivity for Nuclear medicine, Statistical aspects of Nuclear medicine, Basic instrumentation and its clinical applications, Nuclear medicine imaging devices, Physical principles of nuclear medicine imaging procedures, Therapy with radioactivity, Radiation doses in nuclear medicine.

Unit V

Physics of Radiation Therapy: The dose units used in radiotherapy-the Red and the Gray, Principles of radiation therapy, A short course in radiotherapy treatment planning, Megavoltage therapy, Short distance radio therapy or Branchy therapy, Other radiation Sources, Closing thought on Radiotherapy.

Book for Study:

Medical Physics – John R.Cameron and James G.Skofronick, John Wiley & Sons, New York (1978).

II M.Sc.,Physics	Major Paper-11	Marks : 100
Semester III	SOLID STATE PHYSICS – I	Hrs/week: 6
Code: EP148C3J		INT:25, Ext:75

UNIT – I

Periodic arrangements of atoms, concepts of a lattice, lattice translation vectors, Primitive lattice cell, two and three dimensional lattice types, Miiler indices of crystal planes, simple crystal structures like sodium chloride type, cesium 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 sc, bcc and fcc lattices, Fourier analysis of the basis and structure factors of bcc and fcc lattices. (Topics chosen from: Chapters 1 & 2)

UNIT – II

Crystal Binding and Elastic constants: Inert gas crystals, ionic covalent and metallic crystals. Hydrogen Bonds, atomic radii. Analysis of elastic strains, elastic stiffness and compliance constants. Elastic waves in cubic crystals. (Chapter 3)

UNIT – III

Vibrations of linear monatomic and diatomic chains, quantization of elastic waves, phonon momentum. Plank distribution for a system of identical harmonic oscillators. Periodic boundaries conditions and density of states in one and two dimensions. Einstein and Debye's theories of specific heat. Anharmonicity of lattice vibrations, thermal expansion. Thermal conductivity and Umklapp processes (chapters 4 & 5)

UNIT – IV

Energy levels in one dimension. Fermi Dirac distribution for a free electron gas. Periodic boundary condition and free electron gas in three dimensions. Heat capacity of the electron gas. Ohm's law, Matthiessen's rule and Umklapp process. Hall effect. Weidman – Franz law. Nearly free electron model, and the origin and magnitude of the energy gap. Bloch functions. Motion of an electron in a periodic potential Kronig Penny model. Bloch theorem. Approximate solution near a zone boundary (Chapters6 & 7)

UNIT – V

Band gap in semiconductors. Equations of motion, holes and effective mass. Intrinsic mobility, Donor and acceptor states and thermal ionization of donors and acceptors. Reduced and periodic zone schemes. Construction 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 Alphen effect. (Chapters 8 & 9)

Text Books for study:

Introduction to Solid State Physics – Charles Kittel – VII Edition

Chapters 1 to 9.

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)
3. Intermediate Quantum Theory of the Crystalline Solids – A.O.E.Animalu – Prentice Hall of India (1977)
4. Solid State Physics – S.O.Pillai – New Age Publications (1997)

II M.Sc., Physics	Major Paper-12	Marks : 100
Semester III	QUANTUM MECHANICS – I	Hrs/week: 6
Code: EP1+8C32		INT:25, Ext:75

UNIT – I

Inadequacy of classical concepts: Black body radiation – Planck's quantum hypothesis – Specific heats of solids – de Broglie hypothesis – The motion of a free wave packet – Uncertainties introduced in the process of measurement – Diffraction phenomena – interpretation of the wave packet dualism – Complementarities – The Formulation of quantum mechanics.

UNIT – II

Schrödinger equation and stationary states: A free particle in one dimension – generalization to three dimension – The operator correspondence and the Schrödinger equation for a particle subject to forces – Normalization and Probability Interpretation – Non-normalizable wave function and box normalization – 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 potential – Bound states in a square well (E>0) – The square well: Non localized states (E>0) Square Potential Barrier.

UNIT – III

The fundamental postulates of wave mechanics – The adjoint of an operator and self adjointness – The eigenvalue problem; degeneracy – Eigen values and eigenfunctions of self adjoint operators – Dirac Delta function – Observable : Completeness and Normalization of eigenfunctions – 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

Exactly soluble Eigen value problem: The Schrödinger 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 L separation of variables admissibility conditions on solutions: eigen values – The eigen functions: spherical harmonics physical interpretation – Parity Angular Momentum in stationary sets of systems with spherical symmetry – Solution in the interior region solution in the exterior region and Matching – Solution of the Radial equation; Energy levels – Stationary state wave functions discussion of Bound states.

UNIT – V

Approximation methods for stationary 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 energy level of an atom (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 Schrödinger equation – The Bohr – Sommerfeld Quantum Condition.

Text Books for study:

A text book of Quantum Mechanics – P.M.Mathews and 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 Mechanics – E.Merzbacher*
3. *Quantum Mechanics – J.L.Powell and Crassman*
4. *Quantum Mechanics – Schwabl – Narosa Publications*
5. *Quantum Mechanics – B.K.Agarwal and HariPrakash – PHI (1997)*

II M.Sc., Physics	Major Paper-13	Marks : 100
Semester III		Hrs/week: 6
Code: EP1S33	APPLIED OPTICS AND LASER PHYSICS	INT:25, Ext:75

UNIT I

Matrix Methods in Gaussian Optics - Refraction and translation matrices – Image formation Process – Combination of image forming systems – Matrix representation in polarization – Jones calculus Anisotropic medium - Interference by reflections from non – identical interfaces – Interference by multiple reflections.

UNIT II

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

UNIT III

Frequency analysis of imaging system – 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 focusing of light.

UNIT V

Laser - Introduction, stimulated emission and thermal radiation, amplification in a 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 nonlinear optics - B.B.Laud (Wiley eastern).

Books for reference:

1. Optics – M.V Klein andT.E.Furtak. (John Wiley, 1986).
2. Introduction to Modern Optics by G.R. Fowles (Holt Rinehart 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	Major Paper – 14	Marks : 100
Semester III	Practical – III	Hrs/week : 6
Code: EP18C3P		INT:60, Ext:40

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

1. Universality of NAND and NOR gates
2. Verification of De Morgan's theorem and Boolean functions.
3. Active filters – low, high and band pass filters (741)
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. Optimization 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	Non Major Elective - Paper-15(a)	Marks : 100
Semester III	MICROPROCESSORS	Hrs/week: 6
Code: EPH8N31		INT:25, EXT:75

UNIT-I

A detailed look at the 8085 MPU and its architecture 8085 programming – Instruction Classification – Instruction format – how to write, assemble and execute a simple program – Introduction to 8085 instructions – Data transfer operations – Arithmetic operations – Logic operations – Branch operations – 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 it 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 an d16 bit data operations – BCD to binary conversion – Binary to BCD conversion – BCD to seven segment LED code conversion – BCD addition – BCD subtraction – Introduction to advanced instructions and applications – Multiplication – Subtraction with carry: Interrupts – The 8085 interrupts – 8085 vectored interrupts – Restart as software instructions.

UNIT – V

Interfacing data converters: Digital to analog converters – Analog to digital converters – 8255A programmable peripheral interface.

Text Book for study:

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 Publications (Edition 2005), Pune.*
3. *Introduction to Microprocessors by A.P.Mathur (III Edition), Tata McGraw Hill Company, New Delhi.*

II M.Sc., Physics	Non Major Elective-Paper-15(b)	Marks : 100
Semester III		Hrs/week: 6
Code: EP18N32	PROGRAMMING IN C++	INT:25, Ext:75

UNIT I: Data Types, Operators, statements, writing a program in C++ and control statements

Introduction to object oriented programming with C++ - basic concepts-structure – character set - identifiers and key words – Constants – C++ Operators – Type conversion – Declaration of variables – Statements – simple C++ programs – Features of iostream.h-Manipulator functions – Input and Output (I/O) Stream Flags - Conditional Expressions – switch Statement – Loop Statements – Breaking Control statements.

UNIT II: Functions, Program Structures and Arrays

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 – arrays and Functions – Multi Dimensional Arrays – Character Array – Simple programs.

UNIT III: Pointers, Structures, Unions

Pointer Declaration – Pointer Arithmetic – Pointers and Functions – Pointers and Arrays – Pointers and Strings – Arrays of Pointers – Pointers to Pointers – Declaration of Structure – Initialization of structure – Functions and Structures.

UNIT IV: Classes, Objects and Case Studies

Arrays of Structures – Arrays within a Structure – Structure 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 (Nester Class) – Simple Programs.

UNIT-V: Inheritance, Overloading and data file operations

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 operators. 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 operations-Random access file processing.

Text Book for study:

Programming with C++ by D.Ravichandran
Tata Mc Graw – Hill Publishing Company Limited New Delhi (1996)
UNIT I – Chapters 1,2 and 3
UNIT II – Chapters 4,5 and 6
UNIT III – Chapters 7 (Sections 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 Publications, New Delhi (1999)*
3. *Programming in C++ by P.Radhaganesan, Scitech Publications (India)*
4. Programming with C++ - Schaum Series.

II M.Sc., Physics	Major Paper-16	Marks : 100
Semester IV		Hrs/week: 6
Code: EP1+8e41	SOLID STATE PHYSICS II	INT:25, Ext:75

UNIT- I

Dielectric function of the electron gas. longitudinal plasma oscillations. Plasmons. Electrostatic screening. screened coulomb potential Mott transition. screening and phorons in metals. Polaritons 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. (Chapters 10 and 11)

UNIT – II

Superconductivity: its occurrence and its destruction by magnetic fields. Meissner effect. Heat capacity, energy gap, microwave and infrared properties and isotope effect. Stabilization energy of a superconductor. London theory of Meissner effect. Coherence length. Basic ideas of BCS theory. flux quantization. Type II superconductors and vortex state. Singlé particle tunneling DC and AC Josephson effects. Macroscopic quantum interference. High temperature super 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. (Chapters 12 & 13)

UNIT – III

Langevin diamagnetism equation and quantum theory of diamagnetism. Quantum theory of para magnetism. Hund's rules. Crystal splitting factor. VanVleck Temperature independent para magnetism. Ferromagnetism: 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 – Coercivety and hysteresis (Chapters 14 & 15)

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 (Chapters 16 & 18)

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. (Chapter 19, 20 and 21)

Text Book 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)
3. Intermediate Quantum Theory of the Crystalline Solids – A.O.E.Animalu – Prentice Hall of India (1977)
4. Solid State Physics – S.O.Pillai – New Age Publications (1997)

II M.Sc., Physics	**Major Paper-17**	**Marks : 100**
Semester IV	**QUANTUM MECHANICS – II**	**Hrs/week: 6**
Code: BPHPC42		**INT:25, Ext:75**

UNIT-I

Scattering Cross Section: General Considerations: Kinematics of the Scattering Process: Differential and Total Cross Sections – Wave mechanical 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 behavior 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

Representations, Transformations and Symmetries: Quantum States: State Vectors and Wave Functions – The Hilbert Space of State vectors: Dirac notation – Dynamical variables and linear operators – Representations – Continuous basis – The Schrödinger representation – Degeneracy; Labeling 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 variables – symmetries and conservations laws – space inversion – Time reversal.

UNIT – III

Angular Momentum: The eigen value spectrum – Matrix representation of J in the |jm> Basis – Spin Angular Momentum – Non relativistic Hamiltonian Including spin – Addition of Angular Momenta – Clebsch-Gordan Coefficients – Spin Wave Functions for a system of Two Spin-1/2 particles – identical particles with spin.

UNIT – IV

Evolution with Time: 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 Schrödinger 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

Relativistic Wave Equations: 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 States; Dirac Particle in Electromagnetic Fields – Relativistic Electron in a Central Potential: Total Angular Momentum.

Text Book for study:

A Text book of Quantum Mechanics – P.M.Mathews & K Venkatesan – TMH Pub.Com Ltd., New Delhi (1993)

Unit I: Chap. (6) Secs. 6.1 to 6.5, 6.8 to 6.11 & 6.13 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.I. Schiff – III Edition*
2. *Quantum Mechanics – E. Merzbacher*
3. *Quantum Mechanics – Ghatak and Loganathan*
4. *Quantum Mechanics – A.S. Davydov*

II M.Sc., Physics	Major Paper-18	Marks : 100
Semester IV		Hrs/week: 6
Code: EP18e43	**Nuclear and Particle Physics**	**INT:25, Ext:75**

Unit – I:

Physical tools: 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

Unite – 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, Nuclear spin, Moments and Statistics.

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

Beta Rays: Introduction, Continuous β-ray Spectrum – Difficulties Encounter to Understand it, Pauli's Neutrino Hypothesis, Fermi's Theory of Beta Decay, The Detection of Neutrino, Parity Non-conservation in Beta Decay

Introduction to Gamma Emission: Introduction, γ-ray Emission – Selection Rules, Internal Conversion, Nuclear Isomerism.

Unit III:

The Liquid Drop Model of Nucleus: Introduction, Binding Energies 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, Neutron Cycle in a Thermal Nuclear Reactor, Nuclear Reactors.

Unit IV:

The Shell Model Of Nucleus: Introduction, 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-Particle Shell Model – Parabolic Potential, The Single-Particle Shell Model Square Well Potential, Prediction of the Shell Model, The Collective Model of a Nucleus.

Nuclear Force: Introduction, The Ground State of the Deuteron, Magnetic Dipole and Electric Quadrupole 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 Electromagnetic 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, Polarization and photon spin, Angular momentum, parity and C-parity of the photon

Book 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 – An imprint of Addison Wesley 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 & 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 L Cohen – 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 and Nuclear Physics – Fujia Yang and Joseph H. Hamilton – McGraw Hill International Edition (1996)

II M.Sc., Physics	Major Paper-19	Marks : 100
Semester IV	Practical - IV	Hrs/week: 6
Code: EP18C4P		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 liquids
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. Infrared spectral analysis
12. Ultraviolet spectral analysis

II M.Sc., Physics	Major Elective: Paper-20(b)	Marks : 100
Semester IV	MOLECULAR SPECTROSCOPY	Hrs/week: 6
Code: EP18T4J		INT:25, Ext:75

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 and selection rules. Quantum theory, pure rotational – Raman spectroscopy of diatomic and polyatomic molecules. vibrational Raman spectra, applications. Correlation of infrared and Raman spectra.

UNIT - IV

Electronic spectra of molecules: Born-Oppenheimer 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, Chapman & 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.*

II M.Sc., Physics	**Major Elective: Paper-20 (c)**	**Marks : 100**
Semester IV	**FIBRE OPTICS COMMUNICATION**	**Hrs/week: 6**
Code:		**INT:25, Ext:75**

UNIT – I OVERVIEW OF OPTICAL FIBRE COMMUNICATION

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 index numerical aperture (NA).

UNIT – II FIBRE MATERIALS AND FABRICATIONS

Glass fibres – Halide glass fibres – Active glass fibres – Plastic – clad glass fibres – Plastic fibres – Fibre fabrication – Outside vapor phase oxidation – Vapor phase axial deposition – Modified chemical vapor deposition – Double –crucible method.

UNIT – III OPTICAL SOURCES AND DETECTORS

UNIT – IV POWER LAUNCHING, COUPLING AND SIGNAL DEGRADATION

UNIT V FIBRE END FACE PREPARATION

Text Book for study:

Unit-I Chapter-1 Sections-

Unit-II Chapter-2 Sections-

Unit-III Chapter-4 Sections-

Unit-IV Chapter-5 Sections-

Unit-V Chapter-5 Sections-