सत्यमेव जयते

GOVERNMENT OF PUDUCHERRY

DEPARTMENT OF PHYSICS

KANCHI MAMUNIVAR CENTRE FOR PG STUDIES

(AUTONOMOUS)

COLLEGE WITH POTENTIAL FOR EXCELLENCE

(REACCREDITED AT 'A'GRADE BY NAAC)

(AFFILIATED TO PONDICHERRY UNIVERSITY)

PUDUCHERRY – 605 008.

KMCPGS

WHERE POTENTIAL BECOMES ACHIEVEMENT

STRUCTURE OF THE COURSE

M.Sc. PHYSICS – CHOICE BASED CREDIT SYSTEM (CBCS)

SCHEME OF EXAMINATION

SYLLABUS FOR SEMESTER I TO IV

&

M. Phil - PHYSICS - SCHEME OF EXAMINATION

SYLLABUS FOR SEMESTER I & II

(EFFECTIVE FROM THE ACADEMIC YEAR **2018-2019** AND THEREAFTER)

NOTE : REVIEWED BY 8th BOS

STRUCTURE OF THE COURSE
M.Sc. PHYSICS – CHOICE BASED CREDIT SYSTEM(CBCS)
SCHEME OF EXAMINATION
SEMESTERS - I & II

SEMESTER	PAPER NUMBERS	COURSE	CODE	TITLE OF THE PAPER	HOURS/ WEEK(30)	CREDITS	TOTAL CREDITS
S – I	PAPER-I	Hard Core Course - 1	PHHT -101	Classical Mechanics	4	4	18
	PAPER-II	Hard Core Course - 2	PHHT -102	Mathematical Physics	4	4	
	PAPER-III	Hard Core Course - 3	PHHT -103	Electronics and communication	4	3	
	PAPER-IV	Practical - I	PHHP -104	Practical – I	8	4	
	PAPER-V	Soft Core -I	PHSC - 01X (X=1/2/3/4)	From list-I in Annexure-I	4	3	
		Seminar / Tutorial/ Test			6		
S -II	PAPER-VI	Hard Core Course - 4	PHHT- 205	Quantum Mechanics - I	4	4	18
	PAPER-VII	Hard core Course - 5	PHHT -206	Statistical Mechanics	4	4	
	PAPER-VIII	Hard core Course - 6	PHHT- 207	Condensed Matter Physics	4	3	
	PAPER-IX	Practical - II	PHHP -208	Practical – II	8	4	
	PAPER-X	Soft Core -II	PHSC -02X (X=1/2/3/4)	From list-II in Annexure-I	4	3	
		Seminar / Tutorial/ Test			6		

STRUCTURE OF THE COURSE
M.Sc. PHYSICS – CHOICE BASED CREDIT SYSTEM(CBCS)
SCHEME OF EXAMINATION
SEMESTERS-III&IV

SEMESTER	PAPER NUMBER	COURSE	CODE	TITLE OF THE PAPER	HOURS/WEEK (30)	CREDITS	TOTAL CREDITS
S-III	PAPER-XI	Hard Core Course - 7	PHHT-309	Quantum Mechanics - II	4	4	18
	PAPER-XII	Hard Core Course - 8	PHHT-310	Electrodynamics and Plasma Physics	4	4	
	PAPER-XIII	Hard Core Course - 9	PHHT-311	Microprocessor and Microcontroller	4	3	
	PAPER-XIV	Practical - III	PHHP-312	Practical - III	8	4	
	PAPER-XV	Soft Core -III	PHSC-03X (X=1/2/3/4)	From list-III in Annexure-I	4	3	
		Seminar / Tutorial/ Test			6		
S-IV	PAPER-XVI	Hard Core Course-10	PHHT -413	Principle of Spectroscopy	4	4	18
	PAPER-XVII	Hard core Course-11	PHHT-414	Nuclear and Particle Physics	4	4	
	PAPER-XVIII	Hard core Course-12	PHHT-415	Nanoscience	4	3	
	PAPER-XIX	Practical - IV	PHHP-416	Practical –IV	8	4	
	PAPER-XX	Soft Core-IV	PHSC -04X (X=1/2/3/4)	From list-IV in Annexure-I	4	3	
		Seminar / Tutorial/ Test			6		

SEMESTER – I

PAPER – I: CLASSSICAL MECHANICS (CODE: PHHT - 101)

UNIT – I: LAGRANGIAN FORMULATION

Constraints – Classification of constraints - Generalized coordinates – velocity, kinetic energy, momentum and force - Principal of virtual work – derivation. D' Alembert's Principle – Statement and Proof - Lagrange's equations of motion- derivation and application (i) simple pendulum (ii) spherical pendulum - Cyclic coordinates – explanation, Conservation Laws and symmetry properties.

UNIT – II: VARIATIONAL PRINCIPLE AND HAMILTONIAN MECHANICS

Hamiltonian Principle - Deduction of Hamiltonian Principle - Hamiltonian Principle from Lagrange's equation - Hamiltonian's Principle for non – holonomic systems - Hamiltonian's equation of motion – application (i) simple pendulum (ii) spherical pendulum - Hamiltonian's equation from Variational Principle - Integrals of Hamiltonian equations - Canonical Transformations -Poisson Brackets - Poisson Brackets and integrals of motion.

UNIT – III: HAMILTONIAN – JACOBI THEORY

Hamilton – Jacobi equation – derivation - Hamilton's Characteristic Function. Harmonic Oscillator in the Hamilton – Jocobi method. Separation of Variables in the Hamilton – Jocobi method. Action – angle Variables - Harmonic Oscillator in action – angle variables. Kepler problem in action – angle variables.

UNIT – IV: CENTRAL FORCE MOTION AND THEORY OF SMALL OSCILLATION

Centre of mass and frame of reference - Motion in a central force field - Scattering in a central force field. Scattering problem in Laboratory coordinates - Theory of small oscillations. Normal Modes - Two coupled pendulum - Longitudinal vibration of CO_2 molecule.

TEXT BOOKS

1.Classical Mechanics :G. AruldhasPrentice – Hall of India Pvt. Ltd.
2.Classical Mechanics :S.N. Biswas Books- Allied Pvt. Ltd.
3.Classical Mechanics :J.C. Upadhyaya- Himalaya Publishing House
4.Classical Mechanics :N.C. Rana and P.S. Joag-Tata McGraw Hill
5.Classical Mechanics :Gupta , Kumar and Sharma- Pragati Prakashan

BOOKS FOR REFERANCE

1.Classical Dynamics : Donald T. Greenwood-Prentice Hall of India Pvt. Ltd.
2.Classical Mechanics : Herbert Goldstein- Narosa Publishing House
3.Classical Mechanics of Particles and Rigid Bodies: Kiran C. Gupta-Wiley Eastern Ltd.
4.Classical Mechanics : R. Douglas Gregory- Cambridge University Press
5.Introduction to Classical Mechanics: David Morin- Cambridge University Press

SEMESTER – I

PAPER –II: MATHEMATICAL PHYSICS (CODE: PHHT – 102)

UNIT – I: VECTOR SPACES AND TENSORS

Groups , fields and vector spaces – definitions - Linear independence and dependence of vectors - Matrix representation of linear operators. Schmidt's orthogonalisation processes - Schwartz inequality. Fundamentals of Tensors – scalars – definitions of the following: Covariant and Contra variant tensors - Symmetric and anti - symmetric tensors. Quotient law and Metric tensor - Conjugate tensor - Associated tensors. Raising and lowering of indices - The Christoffel symbols and their transformation Laws - Covariant derivative of tensors.

UNIT – II: COMPLEX VARIABLES

Analytic function - Cauchy – Riemann condition for analytic function. Cauchy integral theorem - Cauchy integral formula. Taylor's series and Laurent's Series - Singularities of an analytical function - Residues – Cauchy Residue Theorem - Evaluation of definite integrals.

UNIT –III: SPECIAL FUNCTIONS AND STURM – LIOUVELLE OPERATORS.

Gamma and beta functions and their relations. Hermit, Legendre, Lagaurre and Bessel equations – series expansions. Rodriguez formula – Generating function – Recurrence relations – orthogonal property. Sturm – Liouville operators – Eigen values and Eigen functions.

UNIT – IV: FOURIER AND LAPLACE INTEGRAL TRANSFORMS

Fourier transforms – properties of Fourier transform - Fourier transform of a Derivative - Fourier's sine and cosine transforms of a derivative - Finite Fourier Transforms. Laplace transform – properties of Laplace transforms - Laplace transforms of the derivative of a function - Laplace transforms of integral - Inverse Laplace transform – properties of inverse transforms – partial fraction method - Convolution theorem-solving differential equation using inverse Laplace Transform.

TEXT BOOKS

1.Mathematical Physics: B.D. Gupta – Vikas Pub. House.
2.Vector Analysis Schaum's series : Murray's R. Spiegal – Mc Graw Hill Pvt.Ltd.
3.Fouier – Laplace Schaum's series: Murray's R. Spiegal – Mc Graw Hill Pvt.Ltd.
4.Complex Variable Schaum's series: Murray's R. Spiegal – Mc Graw Hill Pvt.Ltd.
5. Linear Algebra Schaum's Series: Seymour Lipschutz – Mc Graw Hill Pvt. Ltd.
6.Matrices and Tensors: A. W. Joshi - Willy eastern Pvt. Ltd.

BOOKS FOR REFERENCE

1.Elementray Linear Algebra : Howard Anton – John Wiley & Sons.
2.Advanced Engineering Mathematics : M.D. Greenberg – Prentice Hall International.
3. Special Functions and Complex variables:Shahnaz Bathul – PH of India.
4.Mathematical Methods for Physicists : G. Arfken and H. J. Weber – Harcour –PH of India
5.Mathematical Physics : H.K. Dass and Rama Verma – S.Chand.
6.Mathematical Physics:Sathya Prakash-Pragati Prakashan (New Edition).

SEMESTER –I

PAPER –III: ELECTRONICS AND COMMUNICATION (CODE: PHHT – 103)

UNIT – I : DIGITAL CIRCUITS

B C D Adder - Decoder and Encoder - Multiplexer and De-multiplexer. State diagram and state equation - Excitation tables - Design of counters using T, D and J K flip flops - Designs of: shift register, Ripple counters and Synchronous Counter.

UNIT – II : OPERATIONAL –AMPLIFIERS (OP – AMP)

Operational amplifiers and its application - differentiator – integrator. Difference amplifier - Astable multi vibrator - Square wave generation. Schmitt trigger circuit – D/A converter-Ladder type – A /D converter-Parallel comparator method – solution of simultaneous equations.

UNIT – III : MICROWAVE COMMUNICATION

Microwave- radio station - Klystron – operating principle - Apple gate diagram -Velocity modulation - Bunching process - Reflex klystron – operating principle- velocity modulation – Types of Travelling wave guide - Amplification process and analysis - circular and rectangular wave guides - Wave modes.

UNIT – IV: SATELLITE COMMUNICATION

Principle – Satellite orbits – synchronous orbit –Satellite communication systems, satellite subsystems – General block diagram of communication satellite – Block diagram of power subsystems – general block diagram of satellite telemetry unit – satellite earth stations – general block diagram of an earth station – advantages of satellite communication.

TEXT BOOKS

1.Digital Logic and Computer Design: Morris Mano- Prentice Hall of India Pvt, Ltd
2.Digital Principles and Applications: Malvino and Donald Leech- Tata McGraw Hill Ltd
3.Communication Electronics: Frenzel- McGraw Hill
4.Electronic Communication: Rodey and Coohen- Prentice Hall of IndiaPvt, Ltd
5.Satellite Communication: D.C. Agrawel- Khanna Publications

BOOKS FOR REFERENCE

1.Advance Electronics Communication systems: Way Tomasi- Phi Edu
2.Microwave Electronics: K.L. Gupta- Wiley Eastern Ltd
3.Principles of Communication Eng: Umesh Sinha Sathya Prakash – India.
4.Satellite Communication: Timothy , Charles Bostian and Jeremy Allnutt-
Wiley India Pvt, Ltd.
5.Telecom Switching Systems and Network:Thiyagarajan & Viswanathan-
Prentice Hall of India Pvt, Ltd

SEMESTER – I

PAPER –IV (CODE: PHHP –104)

PRACTICAL – I: GENERAL EXPERIMENTS

(ANY 10 EXPERIMENTS)

1. Optical Birefringence by prism method.
2. Abbe's Refractometer - determination of refractive index.
3. Energy gap – Four Probe method.
4. Charge of an electron – Spectrometer.
5. Polarizability of liquids – Hallow prism.
6. Hall effect - Measurement of hall voltage and current.
7. Ultrasonic interferometer – ultrasonic velocity in liquids.
8. Solar cell – distance verses current measurements
9. Dielectric constant of liquids
10. B – H curve – C R O.
11. Michelson Interferometer – wavelength and thickness of mica sheet.
12. Young's Modulus and Poisson's ratio of a material – Elliptical fringes.
13. Young's Modulus and Poisson's ratio of a material – Hyperbolic fringes.
14. Magnetic susceptibility and permeability measurements
15. Viscosity and density measurements of liquid mixtures

Any other Experiment of equal standard.

SEMESTER –I

PAPER –V: SCIENCE AND TECHNOLOGY OF SOLAR ENERGY, HYDROGEN AND OTHER RENEWABLE ENERGY(CODE: PHSC -013)

UNIT- I: Solar Energy: Fundamental and Material Aspects
Fundamentals of photovoltaic Energy Conversion Physics and Material Properties, Basic to Photovoltaic Energy Conversion: Optical properties of Solids. Direct and indirect transition semiconductors, interrelationship between absorption coefficients and band gap recombination of carriers.

UNIT- II: Solar Energy: Different Types of Solar Cells
Types of Solar Cells, p-n junction solar cell, Transport Equation, Current Density, Open circuit voltage and short circuit current, Brief description of single crystal silicon and organic and Polymer Solar Cells, Elementary Ideas of Advanced Solar Cells e.g. Tandem Solar cells, Solid Liquid Junction Solar Cells, Nature of Semiconductor, Principles of Photo- electrochemical Solar Cells.

UNIT- III: Hydrogen Energy: Fundamentals, Production and Storage
Relevance in relation to depletion of fossil fuels and environmental considerations. Solar Hydrogen through Photoelectrolysis, Physics of material characteristics for production of Solar Hydrogen. Brief discussion of various storage processes, special features of solid hydrogen storage materials, Structural and electronic characteristics of storage materials.New Storage Modes.

UNIT- IV: Hydrogen Energy: Safety and Utilization
Various factors relevant to safety, use of Hydrogen as Fuel, Use in Vehicular transport, Hydrogen for Electricity Generation, Fuel Cells, Various type of Fuel Cells, Applications of Fuel Cell, Elementary concepts of other Hydrogen- Based devices such as Hydride Batteries.

TEXT BOOKS:
1.Solar Photovoltaics – Fundamental Application and Technologies: C.S. Solanki- PHI – India.
2.Solar Energy – Fundamentals and Applications:Garg .H, Prakesh-Tata Mc Graw Hill.
3.Solar Energy:S.P. Sukhatme-Tata Mc Graw Hill.
4.Photo electrochemical Solar Cell:Suresh Chandra-Tata Mc Graw Hill.
5.Hydrogen as a Future Energy Carrier:AndreasZuttel, Andreas Borgschutle and Louis Schlapbach-Wiley – VCH.

BOOKS FOR REFERENCE
1.Stephen J. Fonash: Stephen J. Fonash- Academic Press.
2.Fundamentals of solar cells Photovoltaic Solar Cell energy:Academic Press.
3.Physics of Solar cells:Jenny Nelson-Prentice – Hall.
4.Solar Cells:Martin A. Green:Prentice – Hall.
5.Hydrogen as an Energy carrier Technologies System Economy:Winter and Nitch-Springer

SEMESTER – II

PAPER –VI: QUANTUM MECHANICS – I(CODE :PHHT - 205)

UNIT –I : STATIONARY STATE AND EIGEN SPECTRUM

Time independent Schrodinger equation : Square well potential with rigid walls –finite well – Potential barrier – Linear harmonic Oscillator – Schrodinger method – Operator method. Particle moving in a spherically symmetric potential – Hydrogen atom – three dimensional square well potential. .

UNIT –II : MATRIX FORMULATION OF QUANTUM MECHANICS

Quantum state vectors and functions - Hilbert space – Dirac's Bra and Ket Notation - Matrix theory of hormonic oscillator - Schrodinger – Heisenberg and interaction representation - Coordinates and momentum representations. Projection operators - Symmetries and Conservation laws.

UNIT – III : ANGULAR MOMENTUM

Angular momentum – commutation relation - Eigen value spectrum. Matrix representation of J in the $|\, j\ m >$ basis - Spin angular momentum – spin ½ and spin -1 - total wave function-Addition of angular momenta– Clebsch– Gordan coefficients – spin wave function for a system of two spin -1/2 particles.

UNIT – IV: APPROXIMATION METHODS FOR TIME INDEPENDENT PROBLEMS

Time independent perturbation theory: Non – degenerate case – first and second order anhormonic oscillator – Variation method – Principle-Upper bound state – ground State of Helium atom-W K B approximation-Principle-Validity of W K B approximation-Solution near the turning point.- Tunneling through a potential barrier.

TEXT BOOKS

1. Quantum Mechanics: R.K.Srivastava- Printice Hall of India Pvt. Ltd
2. Quantum Mechanics: G. Aruldhas- Printice Hall Of India
3. Quantum Mechanics: Sathya Prakash and C.K.Singh- Kedanath And Ramnath -Meerut
4. Quantum Mechanics: S.L.Gupta,V.Kumar,R.C.Sharma and H.V.Sharma- Jai Nath & Co. India.
5. A Text Book of Quantum Mechanics: P.M. Mathews and K. Venkatesan- Tata Mcgraw Hill.

BOOKS FOR REFERENCE

1.Quantum Mechanics: L.I. Schiff- Mc Graw –Hill
2.Quantum Mechanics: V.Devanathan- Narosa Publishing House
3.The Principles of Quantum Mechanics: P.A.M.Dirac- Oxford University Press
4.Quantum Mechanics: V.K.Thankappan- Wiley Eastern Ltd
5.Quantum Mechanics: E.Merzbacher- John Wiley
6.Advanced Quantum Mechanics: S.L. Gupta and L.D. Gupta- S.Chand&Co India.

SEMESTER – II

PAPER – VII:STATISTICAL MECHANICS(CODE : PHHT -206)

UNIT – I:FOUNDATIONS OF STATISTICAL MECHANICS

Phase Space – States of a system – Density of states – Liouville's theorem. Statistical equilibrium – relation between statistical andthermo dynamical quantities – Classical ideal gas – entropy of mixing – Gibb's paradox.Ensembles – Micro – canonical – canonical – grand – canonical ensembles – Partition function – relation between partition function and thermo – dynamical quantities.

UNIT – II:STATISTICS OF SYSTEMS OF INDEPENDENT PARTICLES

Quantum picture – MB, BE and FD statistics – Limit of applicability of the three distribution Laws – Density matrix. MB ideal gas – Maxwell Law of distribution of velocities – Equipartition Law of energy – Classical real gas – Cluster expansion – Virial theorem- equation of state.

UNIT – III:BOSE – EINSTEIN AND FERMI – DIRAC STATISTICS

IdealBEgas– Gas degeneracy – BE condensation – λtransitionin He 4 - theory of superfluidity (London, Tisza and Landau) – Photon gas – Planck's Law of radiation – Phonon gas – Einstein and Debye's models for specific heat of solids. Ideal FD gas - Gas degeneracy – Electron gas – thermionic emission – Pauli's theory of paramagnetism.

UNIT – IV:FLUCTUATIONS AND PHASE TRANSITION

Energy and density fluctuation - Correlation of space – time dependent fluctuation – Random walk – Brownian motion – Fluctuation dissipation theorem.Phase transitions and critical phenomena – First order and second order phase transitions – Critical indices Scaling hypothesis – Ising model – mean field theories of Ising model (Exact solutions in one dimension) Landau theory.

TEXT BOOKS

1.Statistical Mechanics: B.K. Agarwal and Melvin Eisner-New Age International Publishers – New Delhi.
2.Statistical MechanicsSatyaPrakash and J.P. Agrawal-KedarNath Ram Nath& Co – Meerut.
3.Statistical Thermodynamics: M.C. Gupta-New Age International Publishers – New Delhi4.Statistical Mechanics: S.L. Gupta and V. Kumar- PragatiPrakashan.
5.Staistical Mechanics – Theory and Application – S.K. Sinha - Tata McGraw Hill.

BOOKS FOR REFERENCES

1.Statistical Mechanics: Kerson Huang- Wiley Eastern Ltd.
2.Fundamentals of statistical Mechanics: B.B.Laud- New Age International Publishers – New Delhi
3.Statistical Physics: J.K. Bhattacharjee- Allied Publishers Ltd.
4.Statistical Mechanics: R.K. Srivastava and J. Ashok- Prentice – Hall of India – Private Ltd. New Delhi.
5.Statistical Mechanics – Donald A. McQuarrie – Viva Books Pvt. Ltd.

SEMESTER – II

PAPER – VIII: CONDENSED MATTER PHYSICS(CODE : PHHT-207)

UNIT –I :LATTICE VIBRATIONS AND THERMAL PROPERTIES

Vibration of monoatomic lattices – Lattices with two atoms per primitive cell – Quantization of lattice vibrations – Phonon momentum – inelastic scattering of neutrons by phonons. Lattice heat capacity – Einstein model – density of mode in one – dimension and three dimension – Debye model of the lattice heat capacity –Thermal conductivity – Umklapp process.

UNIT – II:FREE ELECTRON THEORY, ENERGY BANDS AND SEMICONDUCTOR CRYSTALS

Energy levels and density of orbits – Fermi – Dirac distribution – free electron gas in three dimensions – Heat capacity of electron gas– electrical conductivity and Ohm's law –Wideman- Franz law– Hall effect – thermal conductivity of metals – nearly free electron model – electron in a periodic potential(Kroning-Benny model) – Semiconductors: Band gap –effective mass – intrinsic carrier concentration-law of mass action-EF variation with temperature.

UNIT –III:DIAMAGNETISM , PARAMAGNETISM , FERROMAGNETISM AND ANTIFERROMAGNETISM

Classical theory of diamagnetism and paramagnetism–Weiss theory – Quantum theory of paramagnetism–demagnetization of paramagnetic salt – paramagnetic susceptibility of conduction electron –Ferroelectric order – Curie point and the exchange integral – temperature dependence of saturation magnetization–Magnons–thermal excitation of magnons–Ferromagnetic order–Ferromagnetic domains – Origin of domains–Coercive force and hysteresis. Antiferromagnetic order – antiferromagnetic magnons..

UNIT – IV:DIELECTRICS , FERROELECTRICS AND SUPERCONDUCTIVITY

Macroscopic electric field–Local electrical field at an atom–Dielectric constant and polarizability – Clausisus–Mossotti equation–Ferroelectric crystals–Polarization Catastrophe–Ferroelectric domains.

Occurrence of superconductivity-Meissnereffect -thermodynamics of superconducting transition- London equation-Coherence length- BCS theory(basic only)- flux quantization- Type-I and Type-II superconductors- Josephson tunneling effect- DC and AC Josephson effect-SQUID- resent development in high temperature superconductivity-application of superconductors.

TEXT BOKS

1.Solid State Physics: S.O.Pillai- NewAge International Publishers-New Delh.
2.Solid state Physics:B.S.Saxsena, R.C.Gupta and P.N. Saxsena- PragatiPragashan- Meerat.
3.Elements of Solid state Physics: J.P. Srivastava-Prentice Hall of India- Private Ltd.
4.Introduction to Solid State Physics: Arun Kumar-Prentice Hall of India- Private Ltd.
5.Solid State Physics:S.L.Gupta and V. Kumar-K.Nath& Co – Meerut.

BOOKS FOR REFERENCE

1.Introduction to Solid StatePhysics: C. Kittel- John Wiley
2.Solid State Physics:N.W.Ashcroft and N. DavidMermin-W.B.Saunderscompany
3.Solid State Physics:A.J. Dekker-Macmillan India Ltd.
4.Elementary Solid State Physics:M. Ali Omar-Addison Wesley Pub Co
5.Condenser Matter Physics : Agrawal and Prakash – Narosa.

SEMESTER – II

PAPER – IX(CODE : PHHP – 208)
PRACTICAL – II: ELECTRONICS EXPERIMENTS
(ANY 10 EXPERIMENTS)

1. Study of Flip Flops – SR, D and T.
2. Study of Flip flops - JK, Master Slave.
3. Mathematical Operation – OP-AMP – Adder , Subractor and Multiplier.
4. Mathematical Operation OPAMP – Differentiator and Integrator , Inverting and Non- Inverting Amplifier.
5. Solving Simultaneous Equations – Using OP-AMP.
6. Astable Multivibrator – Using OP-AMP.
7. I C 555 Timer (Wave Form Generation)
8. Schmitt Trigger Using 555 Timer.
9. D /A Convertor.
10. A / D Convertor.
11. Multiplexer and Demultiplexer.
12. Encoder and Decoder.
13. Shift Register.
14. Synchronous and Asynchronous Counter.
15. Arithmetic and Logic Unit.

Any other Experiment of equal Standard.

SEMESTER – II

PAPER –X: LASER AND ITS APPLICATIONS(PHSC-024)

UNIT – I: LASER FUNDAMENTALS

A brief general outline of working of Laser. Einstein coefficients - Line shape function - Light amplification - Threshold Condition - Steady state population inversion - Three level and four level systems. Line broadening mechanics : natural - collision and Doppler broadening. Condition for lasing - Quality factor - Q – Switching and Short laser pulses. Q – switching methods : Acousto – optic shutter and electro – optic shutter (Kerr cell and Pocke' s cell)

UNIT – II: LASER SYSTEMS

Helium – Neon laser , Argon ion laser, Carbon dioxide LASER , Nitrogen LASER and excimer LASERS. High density gain media : Ruby LASER , Nd – YAG and Nd –Glass LASERS , semiconductor LASERS, colour centre LASERS and Dye LASERS.

UNIT – III: NON-LINEAR OPTICS

Photo – acoustic Raman scattering. Hormonic generation - Phase matching optical mixing - Self focusing. Multiphoton processes : multiquantum photoelectric effect - Theory of two photon processes - Doppler free two photon spectroscopy - Elementary idea of phase conjugate optics - Laser fluorescence.

UNIT-IV: FIBRE OPTIC COMMUNICATIN

Optical Fibre communication: optical fibres numerical aperture. Pulse dispersion in step index fibers - Modal analysis for a step index fiber. Pulse dispersion - Multimode fibers. First and second generation fiber optic communication. Single mode fiber Gaussian approximation, splice loss. Vector modes optical fibre communications laser ranging.

TEXTBOOK

1.Lasers and Non Linear Optics: B.B.Laud- Wiley Eastern Ltd.
2.Laser Theory and Application: A.K.Ghatak and K.Thyagarajan- Macmillan India Ltd.
3.Laser Principles,Types and Application: K.R.Nambiar- New Age International.
4.Essentials of Lasers and Non – linear optics – G.D. Baruah – Pragati Prakashan

BOOKS FOR REFERENCE

1.Principles of laser: Grazio Svelto- Plemum Press
2.Laser Fundamental: William T. Silfvast- Cambridge University
3.Lasers: Lengyel- Wiley Inter Science

SEMESTER – III

PAPER –XI: QUANTUM MECHANICS – II (CODE : PHHT– 309)

UNIT – I:APPROXIMATION METHODS FOR TIME DEPENDENT PERTURBATION THEORY

Time- dependent perturbation theory – first order transitions – constant perturbation – transition probability : Fermi Golden Rule – periodic perturbation – harmonic perturbation – adiabatic and sudden approximation.Semi – classical theory ofradiation :application of the time dependent perturbation theory to semi – classical theory of radiation –Einsteins coefficients–absorption – induced emission – spontaneous emission – Einsteins transition probabilities– dipole transition – selection rules – forbidden transitions.

UNIT – II: SCATTERING THEORY

Kinematics of scattering process – wave mechanical picture – Green's functions – Born approximation and its validity – Born series – screened coulomb potential scattering from Born approximation.Partial wave analysis : asymptotic behavior – phase shift – scattering amplitude in terms of phase shifts – differential and total cross sections – optical theorem – low energy scattering – resonant scattering – non – resonant scattering - scattering length and effective range– scattering by square well potential.

UNIT –III:RELATIVISTIC QUANTUM MECHANICS

Schrodinger relativistic equation – Klein Gordan equation - charge and current densities –interaction with electro magnetic field – Hydrogen like atom – nonrelativistic limit – Dirac relativistic equation – Dirac relativistic Hamiltonian – probability density – Dirac matrices – plane wave solution – eigen spectrum – spin of Dirac particle - significance of negative eigen states – electron in a magnetic field – spin magnetic moment – spin orbit energy.

UNIT – IV:QUANTISATION OF THE FIELD

Electro magnetic wave as harmonic oscillators – quantisation – classical electromagnetic wave – quantisation of fields oscillators – Photons – number operator – creation and annihilation operators of photons-energy spectrum of wave functions.

TEXT BOOKS

1.Quantum Mechanics:R.K.Srivastava-Printice Hall of India.
2. Quantum Mechanics:G.Aruldhas-Prentice Hall of India.
3.Quantum Mechanics:SathyaPrakash and C.K. Singh-Kedanath and Ramnath–Meert.
4. Quantum Mechanics: S.L. Gupta ,V. Kumar R.C.Sharma and H.V. Sharma-Jai Nath& Co India.
5. Advanced Quantum mechanics:S.Guptha and L.D. Gupta-S. Chand & Co India.

BOOKS FOR REFERENCE

1. Quantum Mechanics:V.Devanathan-Narosa Publishing.
2. Quantum Mechanics:V.K. Thankappan-Wiley Eastern.
3. Quantum Mechanics:E. Merzbacher-John Wiley.
4. A Text Book ofQuantum Mechanics:P.M. Mathews and K. Venkatesan-Tata Mcg raw Hill.

5. Advanced Quantum mechanics:S.Guptha and L.D. Gupta-S. Chand & Co India.

SEMESTER –III

PAPER – XII: ELECTRODYNAMICS AND PLASMA PHYSICS (CODE: PHHT – 310)

UNIT – I: THEORY OF ELECTROMAGNETIC WAVES

Wave equation for vector and scalar potential and solution. Retarded potential and Lienard – Wiechart potential , electric and magnetic fields due to uniformly moving charge and an accelerated charge. Linear circular acceleration – angular distribution of power radiated, Bremsstrahlung , Synchrotron radiation and Cerenkov radiation –reaction force of radiation.

UNIT –II:MOTION OF CHARGE UNDER ELECTROMAGNETIC FIELD

Motion of charged particle in electric, magnetic and electromagnetic field. Uniform electric and magnetic fields. Non- uniform fields, diffusion across magnetic field. Time varying electric and magnetic fields, Adiabatic invariants – first, second and third adiabatic invariants.

UNIT –III:PLASMA PRODUCTION AND PROPERTIES

Production of Plasma – Photo – ionization and thermo ionization . Theory of ionization by collision – ionization by shock waves. Plasma production by Laser. Kinetic pressure of partially ionized gas – mean free path diffusion of charged particle. Ampe – polar diffusion in magnetic field – Debye shielding ,optical properties of Plasma - magnetic susceptibility of Plasma.

UNIT – IV:PLASMA DYNAMICS

Motion of charge particles in homogenous magnetic filed , toroidal magnetic field Magnetic mirror confinement. Motion in a crossed R F and magnetic field .Magnetic hydro dynamics, plasma oscillation, plasma parameters, ion oscillation and waves. Oscillation and waves in magnetic field, propagation of electromagnetic waves in plasma containing magnetic field. Magnetosonic waves, application to nuclear fusion, fusion reactor .Magneto generator –principle of hydrodynamics and working-Fusion reactor(TOKAMAK).

TEXT BOOKS

1.Introduction to Electrodynamics: D. J. Griffiths- D. J. Griffiths.
2. Electromagnetic Theory: K.K.Chopra and G.C.Agrawal- Prentice Hall of India.
3. Basic Electromagnetics: Narayana Rao- Prentice Hall of India.
4. Principles of Electrodynamics: B.Chakraborty- Books and Allied.
5. Foundations of Electromagnetic Theory: J.R. Reitz and R.W.Milford- Narosa Puhblication

BOOKS FOR REFERENCES

1.Classical Electrodynamics: J.D. Jackson- Wiley Eastern.
2. Electromagnetics: J.D.Kraus- Mc Graw –Hill.
3. Electromagnetic waves and radiating systems: E.C.Jordan and K.G.Balmin- Prentice Hall Of India.
4. Plasma Physics: F.F.Chen- Mc Graw Hill.

5. Plasma Physics: S.N.Sen- Pragati Prakasham.

SEMESTER – III

PAPER – XIII: MICROPROCESSORS AND MICROCONTROLLERS (CODE:PHHT – 311)

UNIT –I : MICROPROCESSORS 8085

Architecture of 8085 - Organization of 8085 - Registers in 8085. Addressing modes of 8085 - Instruction set of 8085. Instruction types - Instruction cycles- Interrupt of 8085.

Assembly language Programming: Simple Programmes using arithmetic and logical operations : add, subtract , multiply , AND , OR , XOR. Applications : Stepper motor control systems – temperature control system – traffic light control system.

UNIT – II : MICROPROCESSORS 8086

Architecture of 8086 - Memory organization. Register organization – general purpose, index, pointer, segment registers and flags. BUS structure: data BUS, address BUS, effective and physical address and pipe lining. Addressing modes of 8086: register, immediate, direct and indirect addressing.

UNIT – III : MICROCONTROLLERS 8051

Introduction- comparison between microprocessors and microcontrollers. Architecture of 8051 - Memory organization. Data memory and program memory - Internal RAM and ROM. Addressing modes: immediate, register, direct and indirect. instruction Set of 8051: MOV, Jump, and Call instruction. Assembly language programming: simple program to illustrate arithmetic and logical operations.

UNIT – IV : INTRODUCTION TO ADVANCED PROCESSORS (BASIC AND GENARAL CONCEPT ONLY)

16-bit (INTEL80186) microprocessors: Block diagram. 32–bit (INTEL 80386) microprocessors: Introduction – block diagram. 64-bit (INTEL80586/Pentium) microprocessor : Introduction–Block diagram of Pentium- Moore's Law. Pentium ® 4 processor (basic idea only: Basics of Pentium® 4 Architecture. Basic idea of PC.

TEXT BOOKS

1. Fundamentals of Microprocessors And Microcomputers:B.Ram-Dhanpat Rai Pub.
2. The 8051 Microcontroller: Kenneth J. Ayala- Penram International
3. Microprocessor and Microcontroller: Krishna Kant-Printice Hall of India.
4. Fundamentals of Microprocessor-8086:V.Vijayendran-SV publication.
5. Microprocessor and Microcontrolle:P.S.Manoharan-Charulatha publications.

BOOKS FOR REFERENCES

1. Microprocessors: Gilmore- Tata Mc Graw Hill
2. The 8051 Microcontroller And Embedded Systems: Muhammad Ali Mazidi Janice Gillispie Majidi- Pearson Education.
3.Microcumputer System: The 8086/8088 family-Yu Chang Liu and Glenn A. Gibson- Printice Hall of India.

4.Microcumputer 8086 programming and interfacing: A. Nagoor Kani- RBA publications.
5.. Advanced Microprocessors and Microcontrollers: B.P. Singh Renu Singh-
New Age International Publishers.

SEMESTER – III

PAPER – XIV(CODE : PHHP – 312)

PRACTICAL – III: MICROPROCESSOR 8085 EXPERIMENTS

(ANY TEN EXPERIMENTS)

1. Addition of two 8 bit / 16 bit data without and with carry.
2. Subtraction of two 8 bit/16 data.
3. Multiplication of two 8 bit/16 data.
4. Division of 8 bit data with 8 bit data.
5. Logical operations – AND ,OR& XOR.
6. Code conversion – Hexadecimal to Binary.
8. Code conversion – Decimal to Hexadecimal
9. Largest and smallest of given data in an array.
10 Arranging data in ascending and Descending order.
11 Block operations – Block Copy & Block Fill
12. Square and Cube of a data.
13. Display – moving display.
14. Decimal Counters.
15. Analog to Digital Conversion.

Any other experiments of equal standards.

SEMESTER – III

PAPER – XV: ENVIRONMENTAL PHYSICS(CODE: PHSC-031)

UNIT-I: NATURAL RESOURCES

Renewable and non-renewable resources: Natural resources and associated problems - Forest resources, Water resources, Mineral resources, Food resources, Energy resources, Land resources. Role of an individual in conservation of natural resources, Equitable use of resources for sustainable life styles.

UNIT-II: ECOSYSTEMS

Concept of an ecosystems – Structure and function of an ecosystem – producers, consumers and decomposers.Energy flow in theecosystem – Ecological succession – Foodchains – Introduction, types, characteristic features, structure and function of the following ecosystem – Forest ecosystem – desert ecosystem – aquatic ecosystem.

UNIT-III: BIO-DIVERSITY AND ITS CONSERVATION

Introduction – definition: genetic species and ecosystem diversity; Bio - geographical classification of India, value of biodiversisty - productive use, social, ethical and option values, Biodiversity at global, national and local levels, India as a mega-diversity nation, Hot – spots of biodiversity, Threats to biodiversisty – Habitat loss, poaching of wildlife, man – wildlife conflicts, Conservation of biodiversity – In-situ and ex-situ conservation of biodiversity.

UNIT-IV: ENVIRONMENTAL POLLUTION

Definition: Cause, effect and control measures of Air pollution, Water pollution, Marine pollution, Thermal pollution, Nuclear hazards, solid waste management – causes effects and control measures of urban and industrial waste – Role of an individual in prevention of pollution, pollution case studies, Disaster management – Floods. Earthquake, cyclone.

TEXT BOOKS

1.Environmental Science & Engineering: Dr.A. Ravikrishnan- Sri Krishna Hitech Publishing Company Pvt.Ltd.
2.Environmental Science & Engineering:P.Anandan& R. Kumaravelan-ScitechPublications(India) Pvt. Ltd.

BOOKS FOR REFERENCE

1.Environmental Science and Engineeri: Anubhakaushik and C.P. Kaushik- New Age International Pub
2.Environmental Pollution Control Engineering: C.S.Rao- New Age International Pub.
3.Environmental Chemistry: A.K. De- New Age International Pub.
4.Environmental Studies: ErachBharucha- University Press.
5.Introduction to Environmental Engineering:P.Anandan& R. Kumaravelan-Prentice-Hall of India.

SEMESTER –IV

PAPER – XVI: PRINCIPLES OF SPECTROSCOPY(CODE : PHHT-413)

UNIT – I: INFRARED SPECTROSCOPY

Vibrational study of diatomic molecules – IR rotation – Vibrational spectra of gaseous diatomic molecules – simple gaseous polyatomic molecules – vibrational frequencies and qualitative analysis – Quantitative IR analysis – determination of bond length and moment – determination of interstitial atoms and molecules – IR spectrometer – elementary ideas of FT – IR and spectrometer.

UNIT – II:RAMAN SPECTROSCOPY

Raman effect – Raman shift – definition – observation of Raman spectra – Raman spectrometer – quantum theory of Raman effect – probability of energy transition in Raman effect – vibrational Raman spectra - structure determination fromRamanand IR spectroscopy – General features of electronic spectra of diatomic molecules – Franck – Condon principles – electronic states – configuration of some typical molecules.

UNIT – III:NMR SPECTROSCOPY

Basic principles of interaction of spin and applied magnetic field – quantum mechanical description – concepts of NMR spectroscopy – concept of spin – spin and spin – lattice relaxation process – high resolution continuous wave NMR spectrometer – advantage of FT – NMR – Chemical shift – spin – spin coupling between two and more nuclei – simple application to structural determination.

UNIT – IV:ESR SPECTROSCOPY

Origin of electron spin resonance and resonance condition – quantum mechanical theory of ESR – design of ESR spectrometer – hyperfine structure study – ESR study of anisotropic systems – triplet states study of ESR – application of ESR to solid state physics. (Crystal defects and Biological studies)

TEXT BOOKS

1.Molecular structure and Spectroscopy G. Aruldhas Prentice Hall of India – Private Ltd.
2.Spectroscopy B.K. Sharma Goel Pub House - Meerut
3.SpectroscopyGurdeep R. Chatwal and Sham K. Anand Himalaya Publishing House
4.Vibrational Spectroscopy D.N. Sathiyanarayana New Age international Publishers New Delhi
5.Elementary Organic Spectroscopy Y.R. Sharma S .Chand

BOOKS FOR REFERENCE

1.Fundamentals of Molecular Spectroscopy Colin N. Banwell Tata Mcgraw –Hill Pub – New Delhi
2.Organic spectroscopy Jag Mohan Narosa Publishing House
3.Electron Spin Resonance John E. Wertz and James R. Bolton Chapman and Hall - New York
4 .Molecular spectroscopy Jack D. Graybeal McGraw – Hill Book Co.
5.Organic Spectroscopy William Kemp Palgrave New York

SEMESTER – IV
PAPER – XVII: NUCLEAR AND PARTICLE PHYSICS(CODE: PHHT - 414)

UNIT –I:NUCLEAR FORCE

Central force and tensor forces – ground state of deuteron – Magnetic and quadrupole moments – Charge independence and spin dependence of nuclear forces – n-p scattering and p–p scattering at low energies – effective range theory – High energy nucleon – nucleon scattering – exchange forces – Meson theory of nuclear forces.

UNIT –II:NUCLEAR MODELS

Liquid drop model – Bohr Wheeler theory fission – experimental evidence for shell effects – Shell model – Spin orbit coupling – Magnetic numbers – angular momenta and parities of nuclear ground states –Qualitative discussion and estimates of transition rates – magnetic moments and Schmidt lines – Collective model of Bohr and Mottelson.

UNIT - III:NUCLEAR DECAY

Beta decay – Fermi theory of beta decay – Shape of the beta spectrum – total decay rate – angular momentum and parity selection rules – Comparative half – lives – allowed and forbidden transitions - Selection rules – Parity violations – Two component theory of neutrino decay – detection and properties of neutrino -gamma decay – Multipole transitions in nuclei – angular momentum and parity - selection rules – internal conversion Nuclear isomerism.

UNIT – IV: ELEMENTARY PARTICLES

Baryons and Mesons – their properties, decay models – Strong ,weak and electromagnetic interactions – Hadrons and Leptons , Tau – Theta puzzle – Strangeness –Gellman – Nishijima relations - SU(3) classification of Hadrons – Octets and decouplets – elementary ideas of Quarks.

TEXT BOOKS

1.Nuclear Physics:D.C. Tayal-Himalaya Pub.
2. Nuclear Physics:R.C. Sharma-K. Nath& Co Meerut.
3. Basic Nuclear Physics:B.N. Srivastava-PragatiPrakashan, Meerut.
4. Nuclear Physics:S.N.Ghosal-S.Chand&CopanyLtd.
5.Introduction to elementary particles:D. Griffiths-Wiley International Edition – New York.

BOOKS FOR REFERENCES

1.Nuclear Physics:R.R. Roy & B.P. Nigam-Wiley Eastern Ltd.
2.Theory of Nuclear Structure:M.K. Pal-Affiliated East -West Press Ltd.
3.The Atomic Nucleus:R.D. Evans-Tata McGraw – Hill Pub.
4.Concepts of Nuclear Physics:Bernard L. Cohen-Tata McGraw – Hill Pub.
5.Nuclear and Particle Physics:W.E. Burcham and M. Jobes-Addison Wesley– Japan.

SEMESTER – IV

PAPER – XVIII:NANOSCIENCE (CODE: PHHT - 415)

UNIT – I:INTRODUCTION AND BASIC PROPERTIES OF NANOPARTICLES

Historical perspectives of Nanomaterials – classification of Nanomaterials, Nanorods – Nanotubes and Nanoparticles – Basic state physics – face centered nano – particles. Metal – nonoclusters – Magic Numbers -Modeling of Nano particles- reactivity magnetic clusters –Bulk - to nanotransition – semiconducting Nanoparticles – Optical properties – Photo fragmentation – rare gas – and Molecular clusters – Inert gas Super fluid and molecular clusters.

UNIT – II: CARBON NANO STRUCTURES

New carbon structures – small carbon clusters – Structure of C_{60} – Fullerences – other bulky balls – Carbon nanotubes – fabrication Structures – electrical and mechanical properties – application to computers fuel cells chemical sensors – mechanical reinforcement.

UNIT – III:FERROMAGNETISM AND SPECTROSCOPY OF NANO PARTICLES

Effect of bulk nanostructuring – magnetic properties – dynamics of nanomagnets – nanopore containment – nanocarbonferomagnets – colossal magnetic resistance – Gravitation magnetic resistance – Ferro fluids – spectroscopic study of nanomaterial – qualitative idea of quantum dots.

UNIT – IV:APPLICATION OF NANO TECHNOLOGY

Biological building blocks – Nucleic acid – Biological nanostructures – Micro electro mechanical system – Nanoelectro mechanical system (NEMS) – Nanodevices: and machines – molecular – molecular and super molecular structure – nanobiotechnology – DNA chip, DNA array, drug delivery systems.

TEXT BOOKS

1.Physics of simple metal clusters&microcluster physics:S.Sugano&H.Koizumi-Springer-VerlagHeidalberg(1998)
2.Hand Book of Nanophase Materials:S.N.Khanna-Goldstein Edition, Marcel Decker, Newyork, (1997).
3.Nano Technology in Carbon Materials:R.Saito,G.Dresselhaus&M.S.Dresselhaus-Springer-Verlog(1998).
4.Physicsal Properties of Carbobnano-tubes:R.Saito,G.Dresselhaus&M.S.Dresselhaus-Imperial College Press,London(1999).
5.Hand Book of Nanostructured Materials&Nanotecnology:I.Chang-H.S.Nalwo Edition, Academic Press, Sandiago(2001).

BOOKS FOR REFERENCE

1.Spectroscopy,Theory&Optical Properties of Nanomaterials:H.S.Nalwa&P.Milani-Academic Press, Sandiago(2000)
2.Transport in Nanostructured Materials:D.K.Ferry&S.M.Goodnick-Canbridge University Press,Canbridge,U.K(1997)
3.Hand Book of Nanostructured Materials&Nanotech(Vol.1-5):H.S.Nalwa-Academic Press,Boston(2001)
4.Single electron Transport Through a Quantum Dot:G.Timp-Springer,Berlin(1999)
5.Text Book of Nanoscience and Nanotechnology:B.S.Murthy-University Press Private

Press,Boston(2001)

SEMESTER –IV
PAPER – XIX(CODE : PHHP – 416)
PRACTICALS – IV: ADVANCED EXPERIMENTS
(ANY TEN EXPERIMENTS)

1. Dielectric constants of liquids using LCR bridge.
2. Dielectric constants of solids at different temperatures
3. Solar cells -V/I characteristics for Two sources.
4. Determination of wavelength of laser beams by normal incidence method using diffraction grating.
5. Hall effect - hall voltage and current for magnetic materials
6. Ultrasonic interferometer – velocity and compressibility determination for binary liquid mixtures.
7. GM counter- determination of resolution.
8. GM- counter - verification of inverse square law.
9. Abbe Refractometer - measurement of refractive indices for liquid mixture
10. B – H curve – C R O.
11. Planck’s constant apparatus - Determination of threshold frequencies and Plack's constant.
12. Impedance measurement - Determination of resistance and reactances at different temperatures
13. Viscosity and density measurements of liquid mixtures
14. Michelson Interferometer – wavelength and thickness of mica sheet.
15. Magnetic susceptibility and permeability measurements

Any other Experiment of equal standard.

SEMESTER –IV

PAPER -XX: CHARACTERIZATION OF MATERIALS (CODE : PHSC – 041)

UNIT – I: Structural characterizations

Construction, Principle and working of XRD, SEM, TEM, AFM, XPS, TGA-DTA characterization techniques- Data analysis using above characterization techniques.

UNIT – II: Compositional Analysis

Atomic Absorption Spectrometry: EDAX, Augurelectron spectroscopy- Working, actual determination, limitations, procedure, and experimental analysis.

UNIT – III: Optical Properties

UV–Vis, IR, 2D-NMR and Raman spectroscopy and photoluminescence: principle and working, reflection, absorption, transmission analysis, band gap determination, Identification of molecular groups for radicals in solids, zero phonon mode of vibration, electron-phonon and phonon-phonon interactions and scattering geometry in Raman spectroscopy.

UNIT - IV:Thermal characterization

Theories of TGA,DTA,DSC-Experimental procedure- Data analysis.

TEXT BOOKS

1. Elements of X- ray diffraction By B. D. Cullity, (1956), Addison-Wesley Publishing company Inc., USA
2. X ray theory and experiments by Compton and Alison
3. Instrumental methods of analysis (Vthedition) by Willard, Merritt, DeanSettle
4. Photoelectrochemical solar cells by Suresh Chandra
5. Solar cells by Martin a Green

REFERENCE BOOKS

1. Thin film preparation by Joy George
2. Characterization techniques by ChatwalAnand
3. Modern Raman Spectroscopy: Practical Approach by Deon and Smith
4. Microscopy of materials - D.K. Bowen & C.R. Hall (the MacMillan press Ltd. (London) 1975.
5. Characterization of Materials, John B. Wachtman&Zwi. H. Kalman, Pub. Butterworth-Heinemann (1992)

M.Sc DEGREEUNIVERSITY EXAMINATION
SCHEME OF EXAMINATIONS
(FOR STUDENTS ADMITTED IN 2018-19ONWARDS)

1. External Examination:

Theory paper and Practical Total external mark-60 Marks(each)

2. Internal Assessment(Theory and Practical):

i) The best THREE and Average of best two out of 15Marks -15 Marks
ii)End semester test -15 Marks
iii)Seminar and assignment /Record -10Marks

Total internal marks-40 Marks(each)

TOTAL MARKS - 100 Marks(each)

UNIVERSITY EXAMINATION
M.Sc – PHYSICS
PATTERN OF QUESTION PAPER

I) THEORY QUESTION PAPERS FOR EACH SEMESTER

Time: 3 hours. Maximum: 60 Marks

SECTION – A (4 x 2 = 8)

Answer ALL questions. Each in not more than 50 words. FOUR questions are given and the questions are Definition/Explain/ Describe the following. ONE question from each unit.

SECTION – B (4 x 5 = 20)

Answer ALL questions. Each in not more than 200 words. FOUR questions are given. ONE question from each unit and each question is either or pattern.

SECTION – C (4 x 8 = 32)

Answer ALL questions. Each in not more than 1000 words. FOUR questions are given. ONE question from each unit and each question is either or pattern.

II) PRACTICAL EXAMINATION(END OF EACH SEMESTER)

TIME: 4 Hours Maximum: 60 Marks

a) FORMULA/CIRCUIT/TABULAR COLUMN -20
b) READINGS AND CALCULATION -20
c) RESULT -05
d) VIVA VOCE -15

ANNEXURE-I

LIST OF SOFT CORE PAPERS

LIST- I: SEMESTER-I (PAPER CODE: PHSC-01X)		
PAPER CODE	TITLE OF THE PAPER	CREDIT
PHSC-011	LIQUID CRYSTAL	3
PHSC-012	NONLINEAR DYNAMICS	3
PHSC-013	SCIENCE AND TECHNOLOGY OF SOLAR ENERGY, HYDROGEN AND OTHER RENEWABLEENERGY(Other Department Students also)	3
PHSC-014	ASTROPHYSICS	3
LIST-II: SEMESTER-II (PAPER CODE: PHSC-02X)		
PHSC-021	COMPUTATIONAL PHYSICS	3
PHSC-022	RADIATION PHYSICS	3
PHSC-023	NANO TECHNOLOGY AND ITS APPLICATIONS (Other Department Students also)	3
PHSC-024	LASER AND ITS APPLICATIONS	3
LIST-III: SEMESTER-III (PAPER CODE: PHSC- 03X)		
PHSC-031	ENVIRONMENTAL PHYSICS	3
PHSC-032	CRYSTAL GROWTH	3
PHSC-033	MEDICAL PHYSICS(Other Department Students also)	3
PHSC-034	MAGNETIC NANOPARTICLES	3
LIST-IV: SEMESTER-IV (PAPER CODE- 04X)		
PHSC-041	CHARACTERIZATION OF MATERIALS (only M.Sc. Students other Department also)	3
PHSC-042	BIO-ELECTRONICS(only M.Sc. Students other Department also)	3
PHSC-043	GENERAL CONCEPT IN PHYSICS(Other Department Students also)	3
PHSC-044	PROJECT WORK (for Physics Students only)	3

DEPARTMENT OF PHYSICS, KANCHI MAMUNIVAR CENTRE FOR POST GRADUATE STUDTIES(AUTONOMOUS)
STRUCTURE OF THE COURSE-M.Phil (PHYSICS)
CHOICE BASED CREDIT SYSTEM(CBCS)
SCHEME OF EXAMINATION
SEMESTERS - I & II
(For students admitted in 2018-19 onwards)

SEMESTER	COURSE	CODE	TITLE OF THE PAPER	HOURS/ WEEK (30)	CREDITS	TOTAL CREDITS
S – I	PART-I PAPER-1	MPHT-101	RESEARCH METHODOLOGY	6	6	18
	PART-I PAPER-2	MPHT - 102	ADVANCED QUANTUM PHYSICS	6	6	
	PART-II PAPER-3 (AREA PAPER)	MPHT-103A/B	QUANTUM THEORY OF MOLECULAR SPECTROSCOPY /NANOFERRITES AND CHARACTERISATION	6	6	
	SEMINAR/Tutorial			12	-	
S –II	PART-III	-	DISSERTATION	-	15	18
		-	VIVA- VOCE	-	3	

M.PHIL (PHYSCIS)

PAPER – I: RESEARCH METHODOLOGY (PAPER CODE –MPHT-101)

UNIT – I: ROOT FINDING AND INTERPOLATION METHODS

Errors and approximations in numerical computation – solution of algebric and transcendental equations – successive bisection method – iterative method – the method of false position – Newton Raphson method – Bairstow's method. Interpolation– Newton's formula for interpolation – interpolation with unevenly spaced points – Lagrange's – Hermite's formula – divided difference and their properties – Newton's general interpolation formula.

UNIT – II: NUMERICAL DIFFERENTIATION, INTEGRATION AND CURVE FITTING MTHEODS

Numerical differentiation and integration – trapezoidal rule – Simpon's rule, Romberg integration – Gaussian qudrature formula – Monte Carlo method.Numerical solutions of ordinary differential equations – solutions by Taylor's series – Euler's method – RungeKutta method with Runge's coefficients – simultaneous and higher order equations.Curve fitting – linear least square fit – Non – linear fit, fitting a polynomial function.

UNIT – III: NUMERICAL ANALYSIS OF MATRIXES

Matrices and linear systems of equations – Gauss – Jordan elimination method - Gauss method to compute the inverse of a matrix , Gauss- Seidal iterative method – Eigen values and Eigen vectors of real symmetric matrix by Jocobi's method.

UNIT – IV: TECHNICAL PAPER WRITING AND THESIS WRITING

Preparation of technical papers and thesis writing – art of writing of Scientific articles – writing a thesis – presentation of data – symbols – the observations – tables and figures – equation – the style – sentence length – word length – page and chapter format – referencing – Power point presentation.

TEXTBOOKS FOR REFERENCE

S.NO	TITLE	AUTHOR'S NAME	PUBLISHERS
1.	Thesis Writing	JanathanAnderson	Wiley eastern Ltd –New Delhi
2.	A Handbook of Methodology of research	RajammalP.Devadas and K.Kuladaival	R m MVidyalaya Press Coimbatore
3.	Numerical Methods and Computers	S.S.Kuo	Addison – Wesley
4.	Introductory Methods of Numerical analysis	S.S.Sastry	Prentice – Hall of India – Pvt – Ltd. New Delhi
5	Numerical Methods in science and Engineering	M K Venkataraman	Then National Pub Co

M.Phil(PHYSICS)
PAPER-II: ADVANCED QUANTUM PHYSICS(MPHT-102)

UNIT-I: MANY ELECTRON ATOMS

Indistinguishable Particles – Pauli Principle – Inclusion of Spin – Spin Functions for Two-Electrons – Spin Functions for Three-Electrons – Helium Atom – Central Field Approximation – Thomas –Fermi Model of the Atom – Hartree Equation – Hartree-Fock Equation.

UNIT-II: MOLECULAR BONDING THEORY

Born-oppenheimer Approximation – Variation method- Hellmour- Feynmann theorem-Molecular orbital Method – MO Treatment of Hydrogen Molecule Ion – MO Treatment of Hydrogen Molecule – Diatomic Molecule orbitals – Electronic Configuration of Diatomic Molecules – Valence Bond Method – Valence Bond Treatment of H_2 – Refinements of Simple MO and VB Approximations.

UNIT-III: TIME –DEPENDENT PERTURBATION THEORY

Time dependent Perturbation theory – First order Perturbation –Harmonic Perturbation – Transistors to Continuum states-Absorption and Emission of Radiation – Einstein's A and B Coefficients – Selection Rules – Rayleigh scattering – Raman Scattering.

UNIT-IV: ELEMENTS OF FIELD QUANTIZATION

Classical Field Equation-Lagrangian Form – Classical Field Equation – Hamiltonian Formulation – Quantization of the Field –Quantization of the Schrodinger Equation – Relativistic Fields – Klein-Gordon Field – Dirac Field –Classical Theory of Electromagnetic Fields – Quantization of Electromagnetic Field

TEXTBOOKS FOR REFERENCE

S.NO.	TITLE	AUTHOR'S NAME	PUBLISHERS
1.	Quantum mechanics	P.M. Mathews and K.Venkatesan	Tata MC Graw Hill Publishing Company Ltd.(1992)
2.	Quantum mechanics	G. Aruldhas	Prentice Hall of India (2002)
3.	Quantum mechanics	S.L.Gupta,V.Kumar,R.C. Sharama and H.V. Sharma	Jai Prakash Nath& Publication (2012)
4.	Quantum mechanics	V.K. Thaqnkappan	Ahe International Pvt. Ltd. (2015)
5.	Quantum mechanics	B. K. Agarwal Hari Prakash	Prentice Hall of India Pvt. Ltd. (2004)
6.	Quantum mechanics	G.R. Chatwal & S.K. Anand	Himalaya Publishing House (2004)
7.	Quantum mechanics	R.K. Srivastava	Prentice Hall of India Pvt. Ltd. (2007)
8.	Quantum mechanics	Franz Schwabl	Springer-Verlag (1992)
9.	Quantum mechanics and Field Theory	B.K. Agarwal	Lokbharti Publications (19920
10.	Introduction Quantum Chemistry	A.K. Chandra	Tata MC Graw-Hill Publishing Company

			Limited (1990)

M.Phil(PHYSICS)
PAPER-III:(MPHT-103A)

QUANTUM THEORY OF MOLECULAR SPECTROSCOPY

Unit :I-Quantitative methods of Spectroscopy

Basic principles behind the quantification/ measurement of the following Molecular Parameters: Charge distributions –Lewis, Mullikan, ESP and NBO charges. HOMO and LUMO: energy levels between them for different excited levels. Bond lengths, Bond angles, Dihedral angles and respective force constants during stretching and bending vibrations.Thermodynamical quantities; heat capacity, entropy, enthalpy and Free energy. Electric dipole moment, dielectric constant, polarisabilty and Hyperpolarisabilty. Chemical hardness, chemical potential, Electrophilicity index and Electronegativity.

Unit: II –Atomic and Molecular Orbital Theory

Atomic orbitals: slatter type orbital (STO) and Gaussian type of Orbital (GTO). Molecular orbitals; sigma, pi and delta orbitals – Bonding, Anti bonding and Non bonding orbitals –Wave functions for atomic and molecular orbitals – Frontier molecular orbitals; Theory of HartreeFock (HF),Møller-Plesset (MP), Density functional theory (DFT) and Hybrid Methods (B3LYP) methods – Different types of Basis sets. HOMO and LUMO- NBO – Atomic charges – Mullican charges – Potential energy surfaces – MEP and ESP.

Unit: III - Vibrational and Rotational spectroscopy

Basis classical and quantum theory of vibration and rotation of Diatomic molecules – selection rules – Hot bands in vibrational spectroscopy – P, Q, R branches in rotational spectroscopy. Fourier transformation technique – theory and principle in these spectroscopy- Raman effect – classical and quantum theory – complimenting nature of Raman spectroscopy to vibrational and rotational spectroscopy. Experimental and instrumental details of vibrational/Infrared, rotational/Microwave, and Raman spectroscopy.CARS-SERS-applications.FT IR and FT Raman Instrumentations.

Unit: IV –Principles of UV-Visible, ESR, NMR and NQR spectroscopy

Electronic states of diatomic molecules –Potential energy curve for electronic states of diatomic molecules- Franck condon principle – Electronic states for localized groups. Uv-Visible absorption spectra -Principle- Beer Lambert's law-expression for transmittance and absorbance – chromophores and the importance of conjugation – instrumentation - sampling techniques - Concept of ESR spectroscopy - effect of L-S coupling - Lande splitting factor 'g" – Hyperfine and fine structure.Theory and experimental details of NMR spectroscopy- Chemical shift- spin-spin coupling between two and more nuclei - application to structural determination of molecules- HNMR and CNMR- techniques.

Reference:

1. Wikipedia and other websites.
2. Banwell CN and McCash E.M, 1994, Fundamentals of Molecular Spectroscopy, 4th Edition, Tata McGraw-Hill Publications, New Delhi.
3. A. Singaravelu, Numerical Methods, Meenakshi Agency, chennai Revised edition 2012.
4. Molecular Symmetry & Spectroscopy, by Bunker publisher Overseas ,2/Ed (2005)
5. Infrared and Raman Spectroscopy by R.L Laksh, Publisher: Rajat Publication (2003)
6. Cotton F A, Chemical applications of group theory, Wiley Inter Science.
7. Joshi A W, Elements of group theory for physicists, New Age International Publishers, New Delhi (2005).
8. Sathyanarayana D N, Vibrational Spectroscopy- Theory and Applications,New Age International Publishers, New Delhi.
9. ChatwalAnand, Instrumental Methods of Chemical Analysis, HimalayaPublishing House, New Delhi.
10. Jag Mohan, Organic Spectroscopy Principles and Applications, NarosaPublishing House, New Delhi.
11. Colin N Banwell and Elaine M Mccash, Fundamentals of molecularspectroscopy, Tata McGraw Hill, New Delhi.
12. Molecular Structure and Spectroscopy, G. Aruldhas,Prentice Hall India, NewDelhi.

Levine IRA N, Quantum Chemistry, Prentice Hall of Indian, New Delhi (2000)

M.Phil (PHYSICS)
PAPER-III: (MPHT-103B)
NANO FERRITES AND CHARACTERISATION

UNIT-I: Magnetic Material

Introduction - Basic properties of magnetic materials - Definitions of magnetism - Magnetic Dipole - Magnetic Dipole moment - Magnetic Field - Magnetic flux density (or)Magnetic Induction(B) - Magnetic field Intensity(H) - Magnetisation (or) Intensity of magnetisation(I) - Magnetic susceptibility(χ) - Magnetic Permeability(μ) - Relation Between (χ) and (μ) - Residual magnetism or retentivity or Remanence - Coerctivity (or) Coercive Force.

UNIT-II: Types of magnetic materials and Domain Model

Diamagnetic materials and its properties - Paramagnetic materials and its properties -Ferro magnetic materials and its properties - Anti Ferromagnetic materials and its properties -Ferrimagnetic materials and its properties. Domain Model - Experimental Demonstration of Domain Structure - Hysteresis - Soft and Hard magnetic material - Applications of Magnetic materials: Recording Head materials - Magnetic Parameters for Recording.

UNIT-III: Nanotechnology

NanoParticle: Nanoparticles - Quantum confinement effect - Scale changes everything - Greater Surface to volume ratios - Gravitational force become negligible - Random Molecular motion - Properties of Nano Materials:Optical - Chemical - Thermal - Electrical properties

Techniques for synthesis: Top-Down approach - Bottom-up approach - Chemical precipitation - Microemulsion - Thermal Decomposition Sol-Gel method - Surfactants - Doping in Nanomaterials - Application of Nanomaterials - Fuel cells - Ferrites: Hard and Soft Ferrites - Ferrite structure.

UNIT-IV: Characterization Techniques

X-Ray Diffraction(XRD) - Bragg's law and Diffraction - Identification of Phases - Principle of impedance phase sensitive detection: Introduction - Signal and Referance - Impedance -Data collector - Phase angle - Impedance spectroscopy - Dielectric strength -Dielectric materials - Application of impedance spectroscopy -The scanning electron Microscope - photo luminescence spectroscopy: Types of photoluminescence - Fluorescence - Phosphorescence - Theory - Band gap determination - Impurity levels and deffect detection - Recombination Mechanism - Material quality - Fourier Transform Infrared Spectroscopy (FTIR) EDX Spectroscopy: Energy Dispersive X-ray Analysis - Data Analysis.

TEXTBOOKS FOR REFERENCE

S.NO	TITLE	AUTHOR'S NAME	PUBLISHERS
1.	Solid State Physics	S.O. Pillai	New Age International (P) Limited (2002).
2.	Solid State Physics	Gupta Kumar	K. Nath& Co. Educational Publishers (2006)
3.	Solid State Physics	R.L. Singhal	KedarNath Ram Nath& Co.,(1993)
4.	Nano Science & Technology	Vs Murlidharan&. A. Subramania	Ane Books Pvt. Ltd.(2010)
5.	Molecular Structure and Spectroscopy	G. Aruldhas	Prentie.Hall of India Pvt. Ltd.(2007)
6.	Material Science	M. Arumugam	AnuradhaAgenceies(1998)
7.	Nano Structures Theory & Modelling	C. Delerue& M. Lannoo	Springer(India) Pvt. Ltd. (2004)
8.	Fundamentals of Nanoelectronics	George W. Hanson	Dorling Kindersley (India) Pvt. Ltd. (2009)
9.	Nanotechnology	Mark Ratner & Daniel Ratner	Dorling Kindersley (India) Pvt. Ltd (2008)

10.	Introduction to Nanotechnology	Charles P.Poole,Jr.Frank J.	John Wiley &Sons,INC (2009)

M.Phil DEGREE EXAMINATION
SCHEME OF EXAMINATIONS
(FOR STUDENTS ADMITTED IN 2018-19ONWARDS)

1. Theory papers - I & II

(A) EXTERNAL (University Exam.) - 60 Marks
(B) INTERNAL ASSESSMENT - 40 Marks

i. The best ONE out of THREE tests(10+10+10)-10 Marks
ii. End semester test -10 Marks
iii. Seminar and assignment -20 Marks

Total 40 Marks

TOTAL - 100 Marks

2.Theory paper- III ONLY INTERNAL(Guide paper) - 100 Marks

3.Dissertation
i) INTERNAL - 50 Marks
ii) EXTERNAL - 100 Marks
iii) VIVA - 50 Marks
TOTAL - 200 Marks.

UNIVERSITY EXAMINATION
M. Phil – PHYSICS
PATTERN OF QUESTION PAPER

I. THEORY QUESTION PAPERS I & II (SEMESTER)

Time: 3 hours. Maximum: 60 Marks

SECTION – A(4 x 2 = 8)

Answer ALL questions, each in not more than 50 words. Four questions are given.ONE question from each unit.

SECTION – B (4 x 5 = 20)

Answer ALL questions, each in not more than 1000 words. Four questions are given. One questionsfrom each unit and each question is either or type.

SECTION – C (4 x 8 = 32)

Answer ALL questions, each in not more than 1500 words. Four questions are given. One questions from each unit and each question is either or type.

II. THEORY QUESTION PAPERS -III (SEMESTER)

Time: 3 hours. Maximum: 100 Marks

SECTION – A (8 x 5 = 40)

Answer ANY EIGHT questions. TEN questions are given. Each in not more than 1000 words. Two questions from each unit and remaining two from any of the units.

SECTION – B (4 x 15 = 60)

Answer any FOUR questions. SIX questions are given. Each in not more than 2000 words.One question from each unit and remaining two from any of the units.

KANCHI MAMUNIVAR CENTRE FOR POSTGRADUATE STUDIES (Autonomous)
Lawspet, Puducherry -605008

DEPARTMENT OF PHYSICS

I & II Year Subjects and Syllabus for the year 2018-2019

Semester	Code	Title of the paper	Subject code	Hrs/ week (30)	Credits	Total credits
S1	PHHT-101	Classical Mechanics	Hard core-I	4	4	18
	PHHT-102	Mathematical Physics	Hard core-II	4	4	
	PHHT-103	Electronics and Communication	Hard core-III	4	3	
	PHHP-104	Practical-I	Practical-I	8	4	
	PHSC-01X	SELECT FROM ANNEXURE-I	Soft Core-I	4	3	
S2	PHHT-205	Quantum Mechanics-I	Hard core-IV	4	4	18
	PHHH-206	Electrodynamics and Plasma Physics	Hard core-V	4	4	
	PHHT-207	Condensed matter physics	Hard Cord-VI	4	3	
	PHHP-208	Practical-II	Practical-II	8	4	
	PHSC-02X	SELECT FROM ANNEXURE-I	Soft Core-II	4	3	
S3	PHHT-309	Quantum Mechanics-II	Hard core-VII	4	4	18
	PHHT-310	Statistical Mechanics	Hard core-VIII	4	4	
	PHHT-311	Microprocessor and Microcontroller	Hard Cord-IX	4	3	
	PHHP-312	Practical-III	Practical-III	8	4	
	PHSC-03X	SELECT FROM ANNEXURE-I	Soft Core-III	4	3	
S4	PHHT-413	Principles of spectroscopy	Hard Core-X	4	4	18
	PHHT-414	Nuclear and Particle Physics	Hard core-XI	4	4	
	PHHT-415	Nanoscience	Hard core-XII	4	3	
	PHHP-416	Practical-IV	Practical-IV	8	4	
	PHSC-04X	SELECT FROM ANNEXURE-I	Soft Core-IV	4	3	
TotalCredits						72

Countersigned by

HOD
Seal

Countersigned by

Director
Seal

KANCHI MAMUNIVAR CENTRE FOR POST GRADUATE STUDIES (Autonomous)
Lawspet ,Puducherry – 605008
DEPARTMENT OF PHYSICS
Panel of Examiners forsetting and Evaluation of P.G.courseproposed byBOS : 2018-19

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