"A College is a temple of wisdom, seed bed of character, model of discipline, training ground of democracy and a nursery of great hearts, strong mind, true faith and willing hands. Hence, education has a pivotal role in harvesting the available resources to contribute to the prosperity of the nation"

- Arutchelvar Dr. N. Mahalingam

Holistic Education for the wholesome development of Human personality for the overall well-being of the Humanity as a whole.

Dr. B. K. Krishnaraj Vanavarayar
President

Nallamuthu Gounder Mahalingam College, Pollachi - 1

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REVERBERATION
Sound of Physics

PG DEPARTMENT OF PHYSICS - REVERBERATION

ACADEMIC COUNCIL MEETING

EMPOWER THE YOUTH TO ENRICH THE NATION

11.11.2020

Programme Code:	MSC	**Programme Title:**	Master of Science	
Course Code:	20PPS101	**Title**	**Batch:**	2020- 2022
		Core I: Classical Mechanics	**Semester:**	I
Hrs/Week:	5		**Credits:**	4

Course Objective

- To gain knowledge and understanding of Lagrangian and Hamiltonian formulations of mechanics and to apply them to simple systems.

Course outcomes

K1	CO1	To understand the relation between symmetry operation and classical conservation laws
K2	CO2	To tackle the new problem and application techniques of classical mechanics to far-flung reaches of science
K3	CO3	To get clear understanding of recent intricate theories of modern physics
K4	CO4	To provide smooth transition from traditional techniques to rapidly growing area of non-linear dynamics and chaos

Syllabus

Unit	Content	Hrs
I	**LAGRANGIAN FORMALISM** Constraints and Degrees of freedom - Generalized coordinates: Generalized Displacement, Velocity, Acceleration, Momentum, Force & Potential - Variational techniques and Euler's Lagrange differential equation - Hamilton's Variational principle - Lagrange's equation of motion from Hamilton's principle - Deduction of Newton's second law of motion from Hamilton's principle - Applications of Lagrange's equation of motion**:** Linear harmonic oscillator - Simple pendulum - Isotropic oscillator - Particle moving under central force - *Conservation theorems: Cyclic coordinates - Conservation of Linear momentum - Conservation of energy*	13
II	**HAMILTONIAN FORMALISM** Phase space - Hamiltonian - Hamilton's canonical equation of motion - Significance of H - Deduction of canonical equation from Variational principle -Applications of Hamilton's equation of motion**:** Simple pendulum - Particle in a central field of force - Hamiltonian of a Charged particle in an electromagnetic field - Principle of least action and proof - Canonical transformations - Generating function and different forms - Poisson brackets**:** Definition - Equation of motion in Poisson bracket form - Angular momentum and Poisson bracket relations	13
III	**HAMILTON JACOBI THEORY** Hamilton Jacobi method**:** H J partial differential equation - Solution of H J equation - Discussion on Hamilton's principle function - Solution of harmonic oscillator problem by H J method - Particle falling freely - H J equation for Hamilton's characteristic function - Kepler's problem solution by H J method - Action and Angle variables - Solution of harmonic oscillator problem by action angle variable method	13
IV	**RIGID BODY DYNAMICS** Generalised co ordinates for rigid body motion – Euler's theorem – Euler's angles - Rotational kinetic energy of a rigid body - Equations of motion for a rigid body_ Euler's equations : Lagrange's method – Equation of motion about fixed axis - The motion ofsymmetric top under the action of gravity- Force free motion of symmetrical rigid body.	13

V	**MECHANICS OF SMALL OSCILLATIONS** Stable & Unstable equilibrium –Two coupled oscillators-Formulation of the problem : Lagrange's equations for small oscillations - Properties of T,V and ω - Normal coordinates & normal frequencies of vibration - Systems with few degrees of freedom : Free vibrations of linear triatomic molecule	13
Total contact hours		65

Additional activities

Seminar, Assignment, Experience discussion, PPT

Text Books

- Herbert Goldstein, (2001). *Classical Mechanics.* Addison Wesley Publishing Company, (Units I - IV).
- Gupta S.L. Kumar V. Sharma R.C. (2010). *Classical Mechanics.*Pragati Prakashan, Meeret, (Units I - IV).
- Laxmanan M. Rajasekar S. (1978). *Nonlinear Dynamics.* Springer - Verlag, Distributors: Prism Books Pvt Ltd, Berlin, (Unit - V).

Reference Books

- Rana N.C. Joag P.S. (2001). *Classical Mechanics.* Tata McGraw Hill, New Delhi.

Mapping

PSO/CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	H	H
CO2	H	M	H	H	M
CO3	M	H	H	M	H
CO4	H	H	H	M	H

H – High; M – Medium; L – Low

Designed by	Verified by HOD	Checked by CDC	Approved by COE
Name:Ms.N.Revathi Signature:	Name: Dr.V.Sathyabama Signature:	Name: Mr. K. Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme Code:	MSC	**Programme Title:**	Master of Science	
Course Code:	20PPS102	**Title**	**Batch:**	2020 - 2022
		Core II : Quantum Mechanics	**Semester:**	I
Hrs/Week:	5		**Credits:**	4

Course Objective

- To understand the basic concepts and formalisms in Quantum mechanics

Course outcomes

K1	CO1	Gain good understanding of the principles of quantum mechanics
K2	CO2	Relate abstract formalism to matrix and wave mechanics
K3	CO3	Develop deep knowledge on the role of angular momentum and scattering phenomena in modern physics and technology
K4	CO4	Apply the most appropriate approximation method for solving specific problems

Syllabus

Unit	Content	Hrs
I	**GENERAL FORMULATION OF QUANTUM MECHANICS** Linear vector space –Linear independence of vectors and Dimensions – Basis and expansion theorem – Operators and Linear operator - Postulates of Quantum mechanics – Hermitian operator – Properties of Hermitian operator – Gram Schmidt orthogonalisation procedure - Matrix representation of an operator – Matrix form of wave function -unitary transformation:-change of basis – significant properties unitary transformations – Equations of Motion – Schrodinger, Heisenbreg and Dirac representation - Dual space.	13
II	**APPLICATIONS OF SCHRODINGER EQUATION TO THREE DIMENSIONAL PROBLEMS** Schrödinger's equation for spherically symmetric potentials - Three dimensional harmonic oscillator – The rigid rotator with free axis – Eigen function for the rotator – Rigid rotator in a fixed plane - Motion of a particle in a three dimensional square well Potential – The hydrogen atom: Equations and Solutions of φ, θ and R – Degeneracy – the normal state of hydrogen atom.	13
III	**TIME INDEPENDENT PERTURBATION THEORY** Perturbation theory for a system with Non-degenerate and Degenerate levels - Stark effects in Hydrogen and two electron atoms - The variation method and its application to Hydrogen molecule - WKB approximation and its validity – *Application to barrier penetration*.	13
IV	**ANGULAR MOMENTUM** Angular momentum operator in : Position representation – spherical polar coordinates – Angular momentum commutation relations - Ladder operators – Total angular momentum operator – Eigen values of J^2 and J_z – Matrices for J^2 and J_z, J_+ , J. J_x and J_y – spin Angular momentum - Addition of two angular momenta and CG coefficients – calculation of CG coefficients for $J_1 = ½$ $J_2 = ½$ Calculation CG for p state of electron. Recursion relations of CG coefficients – computation of CG coefficients	13
V	**SCATTERING THEORY** Scattering amplitude and scattering cross section - Integral equation in terms of Green's function - Born approximation and its validity - Application to screened coulomb potential - Partial wave analysis - Optical theorem - Application to low energy two nucleon scattering	13
Total contact hours		65

- *Italic font denotes self study*

Additional activities

Seminar, Assignment, Experience discussion, PPT

Text Books

- Gupta, Kumar, Sharma, *Quantum Mechanics*. Pragathi Prakash Publications, Meerut, (Unit I).
- Satya Prakash, (2007). *Advanced Quantum Mechanics*. Kedar nath Ram Nath, Fifth revised edition, Meerut, (Unit -II).
- Aruldhas, (2002). *Quantum Mechanics*. Prentice Hall India Company Pvt Ltd, New Delhi, (Units I, III & V).
- Gupta S.L. Gupta I.D. (1982). *Advanced Quantum Theory and Fields*. S Chand and Company Ltd, New Delhi, (Unit - IV).

Reference Books

- Mathews, Venkatesan, (2002). *A Text Book of Quantum Mechanics*. Tata McGraw Hill Company Ltd, New Delhi.
- Atkins P.W. (1984). *Quantum Mechanics*. Oxford University Press, Oxford.

Mapping

PSO/CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	H	M	H
CO2	M	H	M	H	L
CO3	L	H	M	H	M
CO4	H	M	H	M	M

H – High; M – Medium; L – Low

Designed by	Verified by HOD	Checked by CDC	Approved by COE
Name: Dr.T.E.Manjulavalli Signature: 	Name: Dr.V.Sathyabama Signature:	Name: Mr. K. Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme Code:	MSC	**Programme Title:**	Master of Science	
Course Code:	20PPS103	**Title**	**Batch:**	2020 - 2022
		Core III: Mathematical Physics	**Semester:**	I
Hrs/Week:	5		**Credits:**	4

Course Objective

- To apply knowledge of mathematical methods in the concepts of Physics

Course outcomes

K1	CO1	To recollect the basic mathematical relations such as tensors, special functions, wave equations etc
K2	CO2	To apply the correct mathematical formulae to solve the expressions in physics
K3	CO3	To implement the functions and equations in the field of physics
K4	CO4	To evaluate the problems in classical quantum and Electromagnetic field theory

Syllabus

Unit	Content	Hrs
I	**SPECIAL FUNCTIONS** Legendre differential equations and Legendre functions - Generating function of Legendre polynomial - Orthogonal properties of Legendre's polynomials - Recurrence formulae for $P_n(x)$ - Bessel's differential equations**:** Bessel's functions of first kind - To solve $J_{1/2}(x)$, $J_{-1/2}(x)$, $J_{3/2}(x)$ and $J_{-3/2}(x)$ - Recurrence formulae for $J_n(x)$ - Generating function of $J_n(x)$ - Hermite differential equation & Hermite polynomials - Generating function of Hermite polynomials - *Recurrence formulae for Hermite polynomials*	13
II	**COMPLEX VARIABLES** Analytic function: definition – The necessary and sufficient conditions for f(z) to be analytic: Cauchy Riemann Differential equations in polar form – Cauchy's integral theorem(Cauchy proof only) - Cauchy's integral formula - Taylor's series and Laurent's series - Singularities of an analytic function - Residues and their evaluation - Cauchy Residue theorem - Evaluation of definite integrals of certain important real integrals.	13
III	**LAPLACE & WAVE EQUATIONS** Solution of Laplace's equation in Cartesian coordinates - Examples of Two dimensional steady flow of heat - Solution of Laplace's equation in two dimensional cylindrical coordinates – Problems - Solution of Laplace's equation in Spherical polar coordinates – Problems – Diffusion equation or Fourier equation of heat flow - Solution of heat flow equation –Variable linear flow-Problems.	13
IV	**FOURIER INTEGRAL AND TRANSFORMATIONS** Fourier Integral– Fourier's Transform: Infinite Fourier sine and cosine transforms - Properties of Fourier's Transform: Addition theorem, Similarity theorem, Shifting property, Modulation theorem- Convolution theorem and Parseval's theorem – Problems – Finite Fourier sine and cosine transforms - Problems – Simple application of Fourier transform: Evaluation of integrals.	13
V	**TENSORS, BETA AND GAMMA FUNCTIONS** n- dimensional space- Superscripts and Subscripts- Transformation of co-ordinates – Indicial convention-Summation convention – Dummy and real indicies -Kronecker delta symbol -Generalised Kronecker delta - Scalars,contravariant and covariant vectors- Tensors of higher ranks - Algebraic operations of tensors – Quotient law - *Symmetric and skew symmetric tensors* - Beta and Gamma functions: Symmetry property of beta function – Evaluation of beta function – Transformation of beta function - Evaluation of Gamma function - Transformation of Gamma function – Relation between beta and gamma function.	13

Total contact hours	65

- *Italic font denotes self study*

Additional activities

Seminar, Assignment, Experience discussion, PPT

Text Books

- Sathyaprakash, (2013). *Mathematical Physics.* Sultan chand & sons, New Delhi, (Units I – V).

Reference Books

- Gupta B.D. (1989). *Mathematical Physics.* Vikas publication house, Noida, U.P.
- Louis A.Pipes, Lawrence R. Harvill, (1970). *Applied Mathematics For Engineers & Physicsts.* McGraw Hill Kogakusha Ltd, New Delhi.
- Chattopadhyay P.K. (1990). *Mathematical Physics.* Wiley Eastern Limited, New Delhi.
- Bose R.K. Joshi M.C. (1984). *Methods Of Mathematical Physics*. Tata McGraw-Hill, New Delhi.

Mapping

PSO/CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	H	M	H
CO2	H	M	L	H	M
CO3	M	H	M	M	H
CO4	H	M	H	M	H

H – High; M – Medium; L – Low

Designed by	Verified by HOD	Checked by CDC	Approved by COE
Name: Dr.M.Karthika Signature:	Name: Dr.V.Sathyabama Signature:	Name: Mr. K. Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme Code:	MSC	**Programme Title:**	Master of Science	
Course Code:	20PPS1E1	**Title**	**Batch:**	2020-2022
		Major Elective I- Applied Electronics	**Semester:**	I
Hrs/Week:	5		**Credits:**	5

Course Objective

- To understand the action of semiconductor devices, amplifiers and oscillators

Course outcomes

K1	CO1	To acquire the basic knowledge in semiconductor devices
K2	CO2	Understand the different types of amplifiers
K3	CO3	Able to design Op-amp Circuits for various practical applications
K4	CO4	Design oscillators and multi-vibrators with the acquired knowledge on electronics

Syllabus

Unit	Content	Hrs
I	**SEMICONDUCTOR DEVICES AND AMPLIFIERS** Semiconductor: Basic ideas- CE transistor characteristics - JFET, Depletion MOSFET and Enhancement MOSFET - Characteristics - UJT and Relaxation Oscillator - SCR & SCR as a switch - Principle of amplification - Classification of amplifiers - Common base, Common emitter RC coupled amplifiers and Frequency response - Hybrid parameters and Small signal analysis - Emitter follower - *Concept of Power amplification & Classification of Power amplifiers* - Transformer coupled class A Power amplifier –Calculation of Efficiency - Class B Push pull amplifier - Complementary symmetry Push pull amplifier – Efficiency calculation - Biasing of FET amplifier - Common source FET amplifier - Common drain FET amplifier.	13
II	**FEEDBACK AMPLIFIER & OSCILLATORS** Concept of Feedback - Negative feedback - Forms of negative feedback - *Effect of negative feedback on bandwidth, distortion, noise and stability* - Positive feedback - Barkhausen criterion - Generation of sinusoidal waves by a tuned LC circuit - Classification of oscillators - Hartley oscillator - Colpitts oscillator - Phase shift oscillator– Frequency calculation - Astable, Monostable and Bistable Multivibrators .	13
III	**OPERATIONAL AMPLIFIER-I** Ideal Op Amp - Inverting Op Amp - Non inverting Op Amp - Voltage follower circuits-- Voltage to current converter - Sample and hold circuit-- Logarithmic amplifier-Constant current source using Op Amp- Realization of constant – current source – Comparators – window detector circuits – Schmitt Trigger -	13
IV	**OPERATIONAL AMPLIFIER-II** Differential amplifier – Common mode and Differential mode – Common Mode Rejection Ratio(CMRR)- Differential Amplifier circuits – Common Mode operation – Differential Mode operation –Characteristics of the nonideal Operational amplifier – Frequency compensation-Practical Operational amplifier.	13
V	**RADIOMETRY AND PHOTOMETRY** Radiometric and photometric flux,Efficacy ,Radiometric and photometric Energy,Radiometric and photometric intensity (Definition only) – Common Radiant Profiles – Optical transfer function and Numerical aperture	13

	DISPLAY DEVICES & DETECTORS Light Emitting Diode: Construction – Electrical and Optical Characteristics – Electroluminescent Source: Electroluminescent lighting panel and Display – Classifications and Characteristics of radiation detectors – Detector Noise – Thermal Detectors: Thermocouple- Pyroelectric detectors – External Photo effect Photoelectric Detectors: Photomultiplier, Internal Photo effect Photoelectric Detectors: Photoconductors	

- *ItItalic font denotes self study*

Additional activities

Seminar, Assignment, Experience discussion, PPT

Text Books

- Norman Lurch, (1981). *Fundamentals Of Electronics.* John Wiley & Sons, New York, (Units I - II).
- Swaminathan Mathu, (1985). *Electronics Circuits And Systems.* 1st Edition, Howard W.Sams & Co, (Units III &IV).
- Endel Uiga, (1995). *Optoelectronics.* Prentice Hall International Editions, New York, (Units V).

Reference Books.

- Salivahanan S. Suresh kumar N. Vallavaraj A. (2003). *Electronic Devices & Circuits.* 10th Reprint, Tata McGraw Hill Publishing Company Limited, New Delhi.
- Robert F.Coughilin, (2001). *Operational Amplifiers & Linear Integrated Circuits.* 6th Edition, Pearson Education Inc, New Delhi.
- Chin Lin Chen, (1996). *Elements Of Optoelectronics And Fiber Optics.* A Time Mirror higher education Group, inc.company, 1996.
- Wilson J. Hawkes J.F.B. (1992). *Optoelectronics – An Introduction.* 2nd Edition Prentice Hall, New Delhi, (Unit V).

Mapping

PSO/CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	M	H	M
CO2	M	H	M	L	M
CO3	L	M	H	M	M
CO4	M	M	H	H	M

H – High; M – Medium; L – Low

Designed by	Verified by HOD	Checked by CDC	Approved by COE
Name: Dr. V. Sathyabama Signature:	Name: Dr. V. Sathyabama Signature:	Name: Mr. K. Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme Code:	MSC	**Programme Title:**	Master of Science	
Course Code:	20PPS204	**Title**	**Batch:**	2020 - 2022
		Core IV: Statistical Mechanics	**Semester:**	II
Hrs/Week:	5		**Credits:**	4

Course Objective

- To understand the concepts of Statistical Mechanics and to apply these concepts to various physical phenomena.

Course outcomes

K1	CO1	To understand the concept of statistical mechanics
K2	CO2	To study the physical properties of a mechanical system in a situation when description is incomplete.
K3	CO3	To understand the average value of thermodynamic system and get clarity on equilibrium and non-equilibrium system
K4	CO4	To explain the microscopic properties of a system on the basis of the dynamical behavior of its constituent particle and realization of atomic theory of matter

Syllabus

Unit	Content	Hrs
I	**CONCEPTS OF STATISTICAL MECHANICS** Phase space – Number of phase cells in given energy range of harmonic oscillator and three dimensional free particle - Volume in Phase space – Ensembles – Micro, Canonical ensemble – Canonical ensemble – Grand canonical – ensemble – Uses of ensemble – Liouvilles theorem - Postulate of equal a priori probability – Statistical equilibrium – Thermal equilibrium - Mechanical equilibrium – Particle equilibrium – Thermo dynamical quantities : entropy – enthalpy – Helmholtz free energy – Gibb's free energy - Chemical potential - Connection between statistical and thermo dynamical quantities	13
II	**CLASSICAL STATISTICS** Microstates and Macro states – Division of phase space into cells - Classical Maxwell Boltzmann distribution law – Most probable speed , Mean speed , Mean square speed , Root mean square speed - Principle of equipartition energy – Gibbs paradox – Partition function and its correlation with thermodynamic quantities. Partition function and their properties, effect of shifting zero level of energy on partition function, mean energy, specific heat, entropy -comparison of ensemble – Equipartition theorem from canonical distribution	13
III	**QUANTUM STATISTICS** Transition from classical statistical Mechanics to Quantum Statistical Mechanics – Indistinguishability in quantum statistics – Statistical weight or a priori probability – Matrices – The density matrix – Postulates – Condition for statistical equilibrium – Identical particles and symmetry requirement – Bose - Einstein distribution law – Fermi – Dirac distribution law - Maxwell Boltzmann statistics - Evaluation of Constant α & β - Results of all three statistics.	13
IV	**APPLICATION OF QUANTUM STATISTICS** Photon gas - Black body radiation and Planck radiation – Specific heat of solids – Einstein theory – Debye theory – Bose Einstein condensation – Liquid Helium - Electron Gas – Free electron model and electronic emission – Pauli's theory of	13

	Para magnetism – *White dwarfs.*	
V	**TRANSPORT PROPERTIES** Boltzmann transport equation – Thermal conductivity – Viscosity from Brownian movement – Onsager solutions – Fluctuations : Energy, Pressure volume, enthalpy – phase transition – First and second order phase transitions - Ising model – Bragg William approximation – One dimensional Ising model.	13
Total contact hours		65

- *Italic font denotes self study*

Additional activities

Seminar, Assignment, Experience discussion, PPT

Text Book

- Gupta, Kumar, (2003). *Statistical Mechanics.* Twentieth edition, Pragati Prakasahan Meerut, Begam Bridge Meerut, (Units I - V).

Reference Books

- Keiser Huang, *Fundamentals of Statistical Mechanics*. Revised edition.
- Agarwal K. Eisner, (1998). *Statistical Mechanics*. Second edition, New Age International Publishers, New Delhi.

Mapping

PSO/CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	H	M	H
CO2	H	M	M	H	M
CO3	M	H	H	M	L
CO4	L	H	H	M	H

H – High; M – Medium; L – Low

Designed by	Verified by HOD	Checked by CDC	Approved by COE
Name: Mr. T. Ponraj Signature:	Name: Dr.V.Sathyabama Signature:	Name: Mr. K. Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme Code:	MSC	**Programme Title:**	Master of Science	
Course Code:	20PPS205	**Title**	**Batch:**	2020-2022
		Core V: Advanced Quantum Mechanics	**Semester:**	II
Hrs/Week:	5		**Credits:**	4

Course Objective

- To familiarize with advanced concepts and methodology of quantum mechanics, quantization of fields and central force problems

Course outcomes

K1	CO1	Acquire thorough knowledge and understanding on the basic principles of quantum mechanics and their applications to various physical and chemical problems
K2	CO2	Understand the effects of special relativity in quantum mechanics and to gain an insight in the quantum field theory
K3	CO3	Apply the concepts of quantum mechanics to quantitatively predict the behavior of physical systems
K4	CO4	Analyse and apply the modern quantum mechanical methods for determining electronic structure of molecules and atoms

Syllabus

Unit	Content	Hrs
I	**TIME DEPENDENT PERTURBATION** Schrodinger equation and general solution - Propagator-Sudden approximation - Perturbation solution for transition amplitude - Selection rule - First order perturbation: constant perturbation, physical interpretation- transition probability: Fermi Golden rule -Scattering of a particle by a potential – Harmonic perturbation : Amplitude for transition with change of energy, transition induced by incoherent spectrum of perturbing frequencies – Interaction of an atom with electromagnetic radiation – Einsteins's transition probability.	13
II	**INDISTINGUISHABLE PRTICLES AND SPIN** Schrodinger equation – Symmetric and Antisymmetric wave function – construction of Symmetric and Antisymmetric functions from unsymmetrised functions: exchange degeneracy – Particle exchange operator - Pauli's Exclusion Principle -spin angular momentum- experimental need for spin– Electron Spin Hypothesis : Stern Gerlach Experiment – limitations – Density operator and density matrix - The EPR Paradox – Quantum entanglement	13
III	**RELATIVISTIC QUANTUM MECHANICS** Klein Gordon equation - Plane wave solutions – Interpretation KG equation – Application of KG equation for a particle in a coulomb field – Dirac's relativistic equation – Dirac matrices - Probability and Current densities - Plane wave solutions – Negative energy states – Existence of electron spin – Spin orbit interaction – Magnetic moment of the electron –Zitter bewegung - Covariant formulation of Dirac equation.	13
IV	**QUANTIZATION OF FIELDS** Field - Quantization procedure for particles - Classical formulation of Lagrangian and Hamiltonian equations of motions - Quantum equation of the field - Quantization of the Schrodinger equation - Klein Gordon field - The Dirac field - Creation, annihilation and number operators.	13

V	**MANY ELECTRON SYSTEMS** One particle central force problem - Non interacting particles and separation of variables - Reduction of the two particles problems - Two particles rigid rotor - Hydrogen atom - Bound state Hydrogen atom wave functions -Hydrogen like orbitals – LCAO - V.B Theory – Hartree Method - Hartree Fock, *SCF method.*	13
Total contact hours		65

- *Italic font denotes self study*

Additional activities

Seminar, Assignment, Experience discussion, PPT

Text Books

- Mathews P.M. Venkatesan, *A Text Book Of Quantum Mechanics*. Tata McGraw Hill Company Ltd, New Delhi, (Unit - I).
- Gupta, Kumar, Sharma, *Quantum Mechanics*. Pragathi Prakash Publications , Meerut, (Unit - I).
- Aruldhas G. *Quantum Mechanics.* Prentice Hall India Company Pvt Ltd, New Delhi, (Units - II & III).
- Satya Prakash R. (2007). *Advanced Quantum Mechanics*. Kedar Nath Ram Nath, Fifth revised edition, Meerut, (Unit -II).
- Chatwal G.R. Anand S.K. (2006). *Quantum Mechanics*. Himalaya Publishing Company, New Delhi, (Unit - IV).
- Ira. N. Levine, *Quantum Chemistry*. Prentice Hall Company Ltd, New Delhi, (Unit - V).

Reference Books

- Gupta S.L. Gupta I.D. *Advanced Quantum Theory And Fields*. SChand and Company Ltd, New Delhi.
- Atkins P.W. *Quantum Mechanics*. Oxford University Press, Oxford.
- Walter. A. Harrison, *Applied Quantum Mechanics*. Applied Publishers Ltd, Mumbai.
- Wu T.Y. Pauchy Hwang W.Y. *Relativistic Quantum Mechanics & Quantum Fields*. Allied Publishers Ltd, New Delhi.

Mapping

PSO/CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	H	H	M
CO2	M	H	M	H	M
CO3	H	M	M	M	H
CO4	H	M	M	H	M

H – High; M – Medium; L – Low

Designed by	Verified by HOD	Checked by CDC	Approved by COE
Name:Dr.T.E.Manjulavalli Signature: 	Name: Dr.V.Sathyabama Signature:	Name: Mr. K. Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme Code:	MSC	**Programme Title:**	Master of Science	
Course Code:	20PPS206	**Title**	**Batch:**	2020 - 2022
		Core VI: Electromagnetic theory & Electrodynamics	**Semester:**	II
Hrs/Week:	5		**Credits:**	4

Course Objective

- To develop the basic knowledge about electromagnetic field and plasma physics

Course outcomes

K1	CO1	To recollect the basic ideas about electric, magnetic fields and fourth state of matter
K2	CO2	To understand the applications of electromagnetic field and plasma physics
K3	CO3	To analyze incompletion of Ampere's law and completion of Maxwell's equation
K4	CO4	Enhanced skill in solving problems by applying electromagnetic field expressions

Syllabus

Unit	Content	Hrs
I	**ELECTROSTATICS AND MAGNETOSTATICS** Concept of charge - Coulomb's law - Gauss law - Multipole expansion of charge distribution - Dielectric and its polarization - Electric displacement D - Polarization of non-polar molecules – Lorentz equation for molecular field - ClaussiusMossotti relation - Polarisation of polar molecules- Langevin equation-Debye relation and molecular structure - Current density - Ampere's law of force - BiotSavart law - Ampere's circuital law - Magnetic scalar and vector potential - Application to magnetic dipole	13
II	**FIELD EQUATION AND CONSERVATION LAWS** Equation of continuity - Displacement current **D** - Maxwell's equations - Energy in electromagnetic field - Poynting vector - Momentum in electromagnetic fields - Electromagnetic potential **A** and ϕ - Maxwell's equations in terms of electromagnetic potential - Concept of Gauge - Lorentz Gauge - Coulomb Gauge - *Retarded potential - Lienard Wiechart potentials*	13
III	**PLANE ELECTROMAGNETIC WAVES PROPAGATION** EM waves in free space –Propagation of E.M waves in Isotropic dielectrics Propagation of E.M waves in Anisotropic dielectrics -Propagation of E.M waves in conducting media - Propagation of E.M waves in ionized media – The dynamic value of conductivity .	13
IV	**INTERACTION OF E.M.W WITH MATTER ON MICROSCOPIC SCALE** Scattering and Scattering parameters- Scattering by a free electron (Thomson scattering)-Scattering by a bound electron (Rayleigh scattering) **INTERACTION OF E.M.W WITH MATTER ON MACROSCOPIC SCALE** Boundary conditions - Reflection and Refraction of EM waves - Fresnel's formula - Brewster's law and polarization of E.M.W - Total internal reflection - Reflection from a metallic surface - Propagation of EM waves between conducting planes	13

V	**RELATIVISTIC ELECTRODYNAMICS 1** Four vectors and tensors - Transformation equations for ρ and $\boldsymbol{J}$ - Transformation equation for $\boldsymbol{A}$ and $\boldsymbol{\varphi}$ - Electromagnetic field tensor - Transformation equation for $\boldsymbol{E}$ and $\boldsymbol{B}$ - Covariance of Maxwell's equations : Four vector form & four tensor form - *Covariance and transformation law of Lorentz force*	13
Total contact hours		65

- *Italic font denotes self study*

Additional activities

Seminar, Assignment, Experience discussion, PPT

Text Books

- Chopra K.K. Agarwal G. C. (1989). *Electromagnetic Theory.* 5th edition K. Nath& Co, Meerut, (Units I – IV).
- Chen F.F. *Introduction To Plasma Physics And Controlled Fusion*. 3rd edition, Plenium press, Newyork , (Unit V).

Reference Books

- David. J. Griffiths, *Introduction To Electrodynamics.* 2nd edition, Prentice Hall of India Private Ltd, New Delhi.
- Gupta Kumar Singh, (1998). *Electrodynamics*. 13th edition, PragatiPrakasam, Meerut.
- Sen S. N. (1999). *Plasma Physics*. 3rd edition, PragatiPrakasam, Meerut.

Mapping

PSO/CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	H	H	M	H
CO2	H	H	H	M	H
CO3	M	H	H	M	H
CO4	M	M	H	M	H

H – High; M – Medium; L – Low

Designed by	Verified by HOD	Checked by CDC	Approved by COE
Name:Ms. N. Revathi Signature:	Name: Dr.V.Sathyabama Signature:	Name: Mr. K. Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme Code:	MSC	**Programme Title:**	Master of Science	
Course Code:	20PPS207	**Title**	**Batch:**	2020-2022
		Major Elective I: Electronic Communications and Cyber security	**Semester:**	II
Hrs/Week:	5		**Credits:**	4

Course Objective

- To develop the scientific skills in the Electronic Communication systems and Cyber security

Course outcomes

K1	CO1	To understand the various modulation techniques and the generation of microwaves
K2	CO2	To apply the basic physical concepts on satellite communication
K3	CO3	To implement the modulation techniques in the RADAR communication systems
K4	CO4	To know about the concepts of internet cyber security

Syllabus

Unit	Content	Hrs
I	**ANALOG COMMUNICATION** Power and energy in a signal-model of communication system- modulation and frequency translation - Amplitude Modulation**:** DSB-SC, SSB, VSB and conventional AM - Superhetrodyne AM receiver - Frequency Modulation**:** Modulation index, spectrum and bandwidth, direct generation and demodulation, superhetrodyne FM receiver - Noise**:** noise power spectral density, white, thermal and shot noise, equivalent noise temperature - Signal to noise ratio and noise figure	13
II	**PULSE MODULATION AND DIGITAL COMMUNICATION** Pulse Modulation: Sampling theorem, informal justification, pulse amplitude modulation, time division multiplexing and pulse time modulation - Pulse code Modulation: Quantization Error, bandwidth, companding and delta modulation - Data Transmission: Base band and radio frequency transmission, FSK and PSK - Information Theory: Rate and measurement, channel capacity, Noisy and noiseless channel - *Shannon's theorem*	13
III	**MICROWAVE SYSTEMS** Microwaves - Multicavity klystron - Reflex klystron - Magnetron - Travelling wave tube Radar and Television Elements of a Radar System-Radar Equation-Radar Performance Factors-Radar Transmitting Systems- Radar Antennas-Duplexers-Radar Receivers and Indicators-Pulsed Systems-Other Radar Systems- Colour TV Transmission and Reception	13
IV	**CYBER SECURITY AND CRYPTOGRAPHY** Overview of Cyber Security: Confidentiality, Integrity and Availability. Threats: Malicious Software (Viruses, Trojans, Root kits, Worms, Botnets), Memory exploits (Buffer Overflow, Heap Overflow, Integer Overflow, Format String). *Cryptography – Authentication, Password System – Windows Security.*	13
V	**NETWORK SECURITY** Network Security – Network Intrusion, Deduction and Prevention Systems, Firewalls. Software Security: Vulnerability Auditing, Penetration Testing, Sandboxing, Control Flow Integrity. Web Security: User Authentication. Legal and Ethical Issues: Cybercrime, Intellectual Property Rights, Copyright, Patent, Trade Secret, Hacking and Intrusion, Privacy, Identity Theft.	13
Total contact hours		65

- *Italic font denotes self study*

Additional activities

Seminar, Assignment, Experience discussion, PPT

Text Books

- Swaminathan Madhu, (1985). *Electronic Circuits And Systems*. 1st Edition, H.W.Sams, (Units I & II).
- Kennedy, Davis, (2002). *Electronic Communication Systems*. 16th Edition, Tata McGraw-Hill, New Delhi, (Units III & IV).
- Dennis Roddy, John Coolen, (2000). *Electronic Communications*. 18th Edition, Prentice-Hall of India, New Delhi, (Unit - III).
- Preston Gralla, (1996). *How The Internet Works*. 1st Edition, Ziff- Davis press, (Unit - V).
- *Chwan-Hwa (John) Wu, J. David Irwin (2016), Computer Networks & Cyber Security, CRC Press*

Reference Books

- Louis E.Frenzel, (2001). *Communication Electronics*. 3rd Edition, Tata McGraw Hill Publishing Company Ltd, New Delhi.
- Wayne Tomasi, (1998). *Electronic Communication Systems*. 3rd Edition, Pearson Education Asia, New Delhi.
- Robert J. Schoenbeck, (1992). *Electronic Communication Systems.*3rd Edition Universal Book Stall.
- Wayne Tomasi, Vincent F.Alisouskas, (1988). *Telecommunications.* Printice- Hall International, New Delhi.

Note:
For Cyber Security, the Study Material will be available in our College Journal Website: www.ngmc.org

Mapping

PSO/CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	H	H	M	H
CO2	H	M	H	H	M
CO3	M	H	H	M	H
CO4	M	H	M	L	H

H – High; M – Medium; L – Low

Designed by	Verified by HOD	Checked by CDC	Approved by COE
Name: Dr. A. Suresh Kumar Signature:	Name: Dr.V.Sathyabama Signature:	Name: Mr. K. Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme Code:	MSC	**Programme Title:**	Master of Science	
Course Code:	20PPS208	**Title**	**Batch:**	2020 - 2022
		Core VIII: General Physics Lab I	**Semester:**	I & II
Hrs/Week:	4		**Credits:**	4

Course Objective

- To understand the techniques of advanced physics experiments

Course outcomes

K3	CO1	To familiarize with the experimental techniques
K4	CO2	To get the idea about the experimental setup and arrangement of device
K5	CO3	To verify the experimental results with theoretical values

List of experiments:

1. Young's modulus - Elliptical fringes - Cornu's method
2. Viscosity of a liquid - Mayor's oscillating disc
3. Thermal conductivity - Forbe's method
4. Temperature coefficient and band gap energy of a Thermistor
5. Measurement of Spot size, Divergence & Wavelength of a Laser beam
6. Young's modulus - Hyperbolic fringes - Cornu's method
7. Specific heat of a liquid - Ferguson's method
8. λ, d λ & Thickness of FP etalon – Fabryperot Interferometer
9. Rydberg's constant - Helium spectrum
10. Refractive index of a liquid & Absorption coefficient of transparent Material –Laser Source
11. Rydberg's constant - Solar spectrum
12. Hall effect in Semiconductors
13. e/m – Thomson's method
14. Stefan's constant
15. Biprism – Determination of λ of monochromatic source & thickness of a transparent sheet

Reference Books

- Worsnop, Flint, (1971). *Advanced Practical Physics*. Asia Publishing house.
- Singh S.P. (Vol. I & Vol. II), (1998). *Advanced Practical Physics.* 11th Edition Pragati Prakashan, Meerut.

Mapping

PSO/CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	H	H
CO2	H	M	M	H	M
CO3	M	H	H	M	M

H – High; M – Medium; L – Low

Designed by	Verified by HOD	Checked by CDC	Approved by COE
Name: Dr.M. Karthika Signature:	Name: Dr.V.Sathyabama Signature:	Name: Mr. K. Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme Code:	MSC	**Programme Title:**	Master of Science	
Course Code:	20PPS209	**Title**	**Batch:**	2020- 2022
		Core IX: Electronics Lab I	**Semester:**	I & II
Hrs/Week:	4		**Credits:**	4

Course Objective

- To understand the working of semiconductor devices, amplifiers and oscillators.

Course outcomes

K3	CO1	Remember the applications of semiconductor devices
K4	CO2	To get the idea and principles of electronics practically
K5	CO3	To access the action of electronic devices such as diode, transistor, UJT and FET etc.

List of experiments:

1. CRO - Familiarization: Lissajous figures, Measurement of Voltage, Phase and Frequency
2. I.C - Regulated power supply
3. RC coupled amplifier - Double stage
4. Feedback amplifier
5. FET amplifier - Common Source
6. Emitter follower
7. UJT - Characteristics
8. FET amplifier - Common Drain
9. Phase shift Oscillator using opamp
10. Power amplifier - Push Pull
11. SCR characteristics
12. Astable Multivibrator using 555 timer IC and Op amp
13. Power amplifier - Complementary symmetry
14. UJT - Relaxation Oscillator
15. Wave shaping circuits - Differentiator, Integrator, Clipper and Clamper

Reference Books

- Paul B. Zbar, Joseph Sloop, (1983). *Electricity & Electronics Fundamentals A Text-Lab Manual.* McGraw Hill, New Delhi.
- Paul B.Zbar, Malvino, Miller, (1997). *Electronics: A Text- Lab Manual.* Mc.Graw Hill, New Delhi.
- Woollard G. (1984). *Practical Electronics*. 2nd Edition, McGraw Hill, New Delhi.
- Subramaniyan S.V. (1983). *Experiments In Electronics*. Macmillan India Ltd, New Delhi.
- Bhargowa N.N. (1984). *Basic Electronics And Linear Circuits.* McGraw Hill, New Delhi.

Mapping

PSO/CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	H	M	H
CO2	M	H	M	H	M
CO3	H	M	H	M	H

H – High; M – Medium; L – Low

Designed by	Verified by HOD	Checked by CDC	Approved by COE
Name: Dr.V.Sathyabama Signature:	Name: Dr.V.Sathyabama Signature:	Name: Mr. K. Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme Code:	M.Sc.	**Programme Title:**	Master of Science	
Course Code:	20PPS2N1	**Title**	**Batch:**	2020-2022
		Non Major Elective : Non Conventional Energy Sources	**Semester:**	II
Hrs/Week:	1		**Credits:**	2

Course Objective

- To study the basic concepts and applications of non conventional energy sources

K1	CO1	To recollect the applications of physics in real world
K2	CO2	To understand the principles of physics involving various natural and artificial process
K3	CO3	To implement the basics laws of physics in the field of non conventional energy sources
K4	CO4	To analyze the efficiency of devices and instruments used in the production of energy

Syllabus

Unit	Content	Hrs
I	**SOLAR ENERGY** Solar radiation at the earth surface – Physical principles of the conversion of solar radiation into heat – Solar water heating – Solar cooking.	3
II	**WIND ENERGY** Wind energy conversion – Site selection consideration – Basic components of a wind energy conversion system (WECS) – *Advantages and disadvantages of WECS.*	2
III	**OCEAN ENERGY** Ocean thermal energy conversion (OTEC) – Methods of ocean thermal energy power generation – Closed cycle OTEC system – Open cycle OTEC system.	2
IV	**GEOTHERMAL ENERGY** A typical geothermal field – Estimates of Geothermal power – Nature of Geothermal fields – Geothermal sources – Advantages and disadvantages of Geothermal energy – *Applications of Geothermal Energy.*	3
V	**CHEMICAL ENERGY** Fuel cells – Design, principle and operation of a fuel cell – Classification of fuel cells – Types of fuel cells – Advantages and disadvantages of fuel cell	3
Total contact hours		13

- *Italic font denotes self study*

Additional activities

Seminar, Assignment, Experience discussion, PPT

Mapping

PSO/CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	H	H	M
CO2	M	H	L	M	M
CO3	M	H	M	H	H
CO4	H	M	M	H	M

H – High; M – Medium; L – Low

Text Books

- G.D.Rai, (2002). *Non-Conventional Energy Sources*. Khanna Publishers, Delhi, (Units I-V).

Reference Books

- G.D.Rai, (1980). *Solar Energy Utilization.* Khanna Publishers, Delhi, 1st edition.
- S.P. Sukhatme, (2000). *Solar Energy Principles of Thermal Collection and Storage.* Tata McGraw Hill, New Delhi, 2st edition.

Designed by	Verified by HOD	Checked by CDC	Approved by COE
Name: Dr. A. G. Kannan Signature: 	Name: Dr.V.Sathyabama Signature:	Name: Mr. K. Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme Code:	M.Sc.	Programme Title:	Master of Science	
Course Code:	20PPS2N2	Title	Batch:	2020 - 2022
		Non Major Elective: Biomedical Instrumentation	Semester:	II
Hrs/Week:	1		Credits:	2

Course Objective

- To apply knowledge of physics in the field of biomedical instrumentation

Course outcomes

K1	CO1	To recollect the basics of physics related to biology
K2	CO2	To understand the concepts of biomedical instruments
K3	CO3	To implement the knowledge in the construction and operation of instruments
K4	CO4	To analyze the process of operation

Syllabus

Unit	Content	Hrs
I	**BIOPOTENTIAL RECORDERS** Introduction – Characteristics of the recording system – Electrocardiography (ECG) – Electroencephalography (EEG) – Electromyography (EMG)	3
II	**PHYSIOLOGICAL ASSIST DEVICES** Introduction – Pacemakers – Pacemaker batteries – Artificial heart valves – Defibrillators	2
III	**OPERATION THEATRE EQUIPMENT** Introduction – Surgical diathermy – Shortwave diathermy – Microwave diathermy – Ultrasonic diathermy	2
IV	**SPECIALIZED MEDICAL EQUIPMENT** Introduction – Blood cell counter – Electron microscope – Radiation detectors – *Digital thermometer*	3
V	**ADVANCES IN BIOMEDICAL INSTRUMENTATION** Introduction – Lasers in medicine – Endoscopes – Computer tomography – Magnetic resonance imaging	3
Total contact hours		13

- *Italic font denotes self study*

Additional activities

Seminar, Assignment, Experience discussion, PPT

Text Book

- M. Arumugam, (2002) *Biomedical Instrumentation*, Anuradha Agencies (Units I-V).

Reference Book

- John G. Webster, (2004) *Medical Instrumentation Application and Design*, John Wiley and Sons, New York.

Mapping

PSO/CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	H	H	H	M
CO2	H	L	M	M	H
CO3	M	H	M	H	M
CO4	H	M	H	H	M

H – High; M – Medium; L – Low

Designed by	Verified by HOD	Checked by CDC	Approved by COE
Name: Dr. A. G. Kannan Signature: 	Name: Dr.V.Sathyabama Signature:	Name: Mr. K. Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	MSc	**Programme Title :**	Master of Science	
Course Code:	20PPS310	**Title**	**Batch :**	2020-2022
		Core X: Molecular Spectroscopy	**Semester**	III
Hrs/Week:	5		**Credits:**	4

Course Objective

- To develop the skill to gain knowledge in Molecular Spectroscopy

Course Outcomes

K1	CO1	To recollect Symmetry operations and learn about Group theory
K2	CO2	To understand the origin of Microwave, Raman and IR spectroscopy
K3	CO3	To deploy the conditions for resonance in NMR, ESR, NQR and Mossbauer Spectroscopy
K4	CO4	To review the theory and applications of NMR, ESR, NQR and Mossbauer Spectroscopy

Syllabus

Unit	Content	Hrs
I	**MOLECULAR SYMMETRY & GROUP THEORY** Group - Group Multiplication table - Classes - Symmetry elements and Symmetry operations –Symmetry planes and reflections - Invertion centre - Proper axes and proper rotations - Improper axes and improper rotations - Point groups - A systematic procedure for symmetry classification of molecules - Representations of a group - The Great Orthogonality theorem and its consequences - *Character tables*	13
II	**MICROWAVE SPECTROSCOPY** Rotation of molecules – Rigid Diatomic molecule – Intensities of spectral lines - Effect of isotopic substitution –Non rigid rotator –Spectrum of non rigid rotator – Polyatomic molecules: Linear molecules - Symmetric top molecules - Techniques and Instrumentation.	13
III	**IR SPECTROSCOPY** Vibrating diatomic molecule: Energy of a diatomic molecule – Simple harmonic oscillator - Diatomic Vibrating Rotator - Vibrations of Polyatomic molecules: Fundamental vibrations and their symmetry – Overtone and combination of frequencies - Fourier transform IR spectroscopy **RAMAN SPECTROSCOPY** Quantum theory of Raman Effect - Classical theory of Raman effect: Molecular polarizability - Pure Rotational Raman spectra: Linear molecules – Symmetric top molecules - Vibrational Raman spectra: Raman activity of vibrations- Rule of Mutual Exclusion – Overtone and combination of vibrations - Structure determination from Raman & IR spectroscopy - Techniques & Instrumentation	13
IV	**RESONANCE SPECTROSCOPY** Magnetic properties of Nuclei - Resonance condition - Bloch equations and their Steady State solutions - Chemical shift – NMR instrumentation - Applications: NMR imaging - *Concept and theory of Electron Spin Resonance* – ESR spectrometer	13
V	**NQR, MOSSBAUER AND ELECTRONIC SPECTROSCOPY** Quadruple nucleus – Principle of NQR – Transitions for axially and non axially symmetric systems: Frequencies of transitions – Half Integral Spins – Integral Spins – NQR Instrumentation – Regenerative continuous wave oscillator method - Applications: Chemical bonding -Halogen quadrupole resonance - Principle and theory of Mossbauer Effect - Mossbauer instrumentation - Applications - Electronic spectroscopy - Vibrational coarse structure of electronic spectra - Frank Condon principle - Fortrat parabole	13
Total contact hours		65

- *Italic font denotes self study*

Additional activities

Seminar, Assignment, Experience discussion, PPT

Text Books

- Albert Cotton F. (1971). *Chemical Application of Group Theory*. 2nd edition, Wiley Interscience, New York, (Unit - I).
- Banwell C.N. Mccash E.M. (2001). *Fundamental Of Molecular Spectroscopy*. TataMcGraw Hill Publishing Company Ltd.,New Delhi, (Units II & III).
- Aruldhas G. (2001). *Molecular Structure and Spectroscopy*. Prentice Hall of India Pvt Ltd New Delhi, (Units IV & V).

Reference Books

- Barrow G.M. *Introduction to Molecular Spectroscopy*. Prentice Hall of India Pvt Ltd, New Delhi.
- Chatwal and Anand, *A Text Book Of Spectroscopy*. Prentice Hall of India Pvt Ltd, New Delhi.
- Manas Chanda, *Atomic Structure and The Chemical Bond*. 2nd edition, Tata McGraw Hill Publishing Company, New Delhi.

Mapping

PSO/CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	H	H
CO2	H	H	H	H	H
CO3	H	M	H	H	M
CO4	M	H	M	H	H

H – High; M – Medium; L – Low

Designed by	Verified by HOD	Checked by CDC	Approved by COE
Name: Dr.M.Karthika Signature:	Name: Dr.V.Sathyabama Signature:	Name: Mr. K. Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme Code:	MSC	**Programme Title:**	Master of Science	
Course Code:	20PPS311	**Title**	**Batch:**	2020 - 2022
		Core XI: Condensed Matter Physics	**Semester:**	III
Hrs/Week:	5		**Credits:**	4

Course Objective

- To provide coherent perspective of the physical concepts and theories related with the characterization of materials

Course outcomes

K1	CO1	Provide an in-depth knowledge of structure of crystals
K2	CO2	Analyze the different properties like electric, magnetic and thermal and develop the skills for research
K3	CO3	Acquire deep understanding in the field of material science
K4	CO4	To emphasize the applications of superconductors in industry and medical fields

Syllabus

Unit	Content	Hrs
I	**GEOMETRY OF CRYSTALS** Lattice parameter and space lattice – The Basics and crystal structure – Unit cells and lattice parameters – Crystal systems – Bravais space lattices- Metallic crystal structures- Directions, Planes and miller indices-Important features of miller indices of crystal planes- Separation between lattice planes in a cubic crystals - Crystal bonding – Primary bonds – Covalent, Metallic, Ionic bonding - Van der Waals bond – Hydrogen bond (formation & properties) – Bond energy of NaCl molecule – Calculation of Lattice energy of ionic crystal – Calculation of Madelung constant of ionic crystals-Reciprocal lattice – Concept of reciprocal lattice - Properties of reciprocal lattice – X-ray diffraction – Bragg's law – Bragg's X-ray spectrometer – Powder crystal methods *Point defects, Dislocations and Color centers(Basic ideas only)*	13
II	**LATTICE VIBRATIONS OF SOLIDS &THERMAL PROPERTIES** One line of atoms – the linear diatomic lattice – Quantization of lattice vibrations – Experimental determination of dispersion relation - Inelastic scattering of neutrons - The specific heat – Lattice specific heat – Classical theory - Einstein theory – The Debye theory – Born's modification – Thermal conductivity – Lattice thermal conductivity – Phonon mean free path – The Umklapp processes	13
III	**FREE ELECTRON THEORY AND BAND THEORY OF SOLIDS** Classical free electron theory of Drude-Lorentz – Sommerfeld quantum theory (Energy levels in one and three dimensions) – Fermi Dirac distribution – Density of states – Fermi energy – Wave functions in a periodic lattice and the Bloch theorem – Behaviour of an electron in a periodic potential (Kronig Penney model) – Brillouin zone – Number of possible wave functions in a band - Motion of electrons in one dimensional periodic potential (crystal momentum, velocity, effective mass, negative effective mass and holes)	13

IV	**FERRO ELECTRIC AND MAGNETIC PROPERTIES OF SOLIDS** Ferroelectric crystals – Properties of Rochelle salt and $BaTiO_3$ - Polarization Catastrophe – Ferroelectric domains –Piezoelectricity – Langevin's theory of Diamagnetism and Para magnetism – Quantum theory of Diamagnetism and Para magnetism – Cooling by adiabatic demagnetization - Weiss theory of Ferromagnetism - Ferromagnetic domains – Neel model of Anti ferromagnetism – *Neel model of Ferrimagnetism*	13
V	**SUPERCONDUCTORS** Mechanism of Superconductors – Effects of magnetic field – Critical current – Meissner effect – Type I and Type II Superconductors - London equations - Thermodynamics of Superconductors - BCS theory - Quantum tunneling - Josephson's tunneling - Theory of AC & DC Josephson effect - High temperature Superconductors	13
Total contact hours		65

- *Italic font denotes self study*

Additional activities

Seminar, Assignment, Experience discussion, PPT

Text Books

- Kittel C. (2004). *Introduction to Solid State Physics.* Revised 7th edition, John Wiley & sons, New York, (Unit-I).
- Srivastava J.P. (2001). *Elements of Solid State Physics*. 6th Edition, Prentice hall of India, , New Delhi, (Unit-I).
- Singhal R.L. (1989). *Solid State Physics*. 4th edition, Kedarnath Ramnath & Co, Meerut, (Unit-II).
- Pillai S.O. (2001). *Solid State Physics*. 4th Edition, New Age international (P) Ltd, NewDelhi, (Units III - V).

Reference Books

- Richard Christman J. (1998). *Fundamentals Of Solid State Physics*. 1st Edition, Library of congress cataloguing.
- Decker A. J. (1963). *Solid State Physics.* 1st Edition, Macmillan & Co, Madras.

Mapping

PSO/CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	M
CO2	H	M	H	H	M
CO3	M	H	H	M	M
CO4	H	M	L	M	H

H – High; M – Medium; L – Low

Designed by	Verified by HOD	Checked by CDC	Approved by COE
Name: Dr.A.Suresh kumar Signature:	Name: Dr.V.Sathyabama Signature:	Name: Mr. K. Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme Code:	MSC	Programme Title:	Master of Science	
Course Code:	20PPS3E2	Title	Batch:	2020-2022
		Major Elective II: Thin film & Nano science	Semester:	III
Hrs/Week:	5		Credits:	5

Course Objective

- To develop the knowledge about fundamentals of Thin Film and Nano science

Course outcomes

K1	CO1	To understand the concepts of Thin Films
K2	CO2	To study the design of different synthesis methodologies of thin film and nanoscience
K3	CO3	To familiarize with the basics of Nanotechnology and Quantum structure
K4	CO4	To understand the characteristic techniques of various analysis

Syllabus

Unit	Content	Hrs
I	**Thin film** Nature of thin film, Thermodynamics of nucleation, Film growth, Deposition parameters& grain size, Epitaxy, Incorporation of defects, Impurities in thin films. **Deposition Techniques:** Physical Vapour deposition:Thermal Evaporation, RF Sputtering, **Reactive sputtering, Chemical vapour deposition:** Pyrolysis, Chemical deposition: Chemical Bath deposition.	13
II	**Properties of thin films** **Optical properties:** Reflection, Transmission, Absorption, Energy band gap, Transition. **Electrical properties:** Sheet resistance, Measurement of sheet resistance, Temperature co-efficient of resistance (TCR), Influence of thickness on resistivity, Hall effect and Magneto resistance **Application:** ***Integrated circuits***	13
III	**Nanoscience** Introduction, Moore's laws - classification of **nanostructures** – quantum confinement- Summary of electronic properties of atoms and solids: **Isolated atom, Bonding between atoms, Giant molecular solids,** Free electron model and energy bands, Electronic conduction - How nanoscale dimension affect properties: Structural properties, Thermal properties, chemical properties, Mechanical properties, Magnetic properties, Optical properties, Electronic properties, Biological systems.	13
IV	**Structure and properties of Nanoparticles** **Nanofibers, inorganic nanotubes and nanowires,** Metal nanoclusters: Magic numbers, Geometric structure, Electronic structure, Reactivity, Magnetic properties. Semiconducting nanoparticles: Optical properties, Photo fragmentation, coulombic explosion, excitons, SET, Carbon nanostructures: Introduction- Carbon nanoclusters-carbon nanotubes-properties-Application.	13
V	**Synthesis and Characterization of Nanoparticles** **Growth mechanism : Vapour liquid solid growth(VLS), Vapour solid growth(VS)** Top down approach (Physical method): Lithography-Ball milling -Laser induced evaporation Bottom up approach (Chemical method): Sol-gel process-Self assembly-Solvo thermal process- Electro chemical synthesis - Thermolysis, **Electrospinning**	13

	Characterization: XRD – **Scanning tunneling microscopy- Atomic force microscopy-** IR and Raman spectroscopy-UV spectroscopy-Photo luminescence spectroscopy.	
	Total contact hours	65

Additional activities

Seminar, Assignment, Experience discussion, PPT

Text Books

- Goswami A(1996) Thin film fundamentals A New Age International
- L I Maissel and R Clang Hand book of Thin Film technology, Frey,Hartmut,Khan,Hamid
- Charles P. Poole, Frank J. Owens, (2011), *Introduction to Nanotechnology*, John Wiley & Sons, New York, (Units IV).
- Robert W.Kelsall, Ian W.Hamley,Mark Geoghegan. Nanoscale Science and Technology, John Wiley & Sons,Ltd.(III & V)

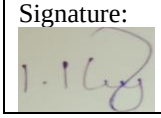
Reference Books

- Muralidharan V.S. Subramania A. *Nanoscience and Technology*. Ane Books Pvt Ltd – I Edition, New Delhi, (Units IV & V).
- Guozhong CAO, (2008). *Nano Structures And Nano Materials*. Imperial College plus, London.

Mapping

PSO/CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	H	H	H	H
CO2	H	M	H	H	M
CO3	H	H	H	H	H
CO4	H	H	H	M	H

S – Strong; H – High; M – Medium; L – Low

Designed by	Verified by HOD	Checked by CDC	Approved by COE
Name: Ms. S.Shanmugapriya Signature: 	Name: Dr.V.Sathyabama Signature:	Name: Mr. K. Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme code:	MSC	**Programme Title :**	Master of Science	
Course Code:	20PPS412	**Title**	**Batch :**	2019 - 2021
		Core XII: Lasers & Non-Linear Optics	**Semester:**	IV
Hrs/Week:	5		**Credits:**	4

Course Objective

- To develop the skill to gain knowledge in Lasers and Non-linear optics

Course Outcomes (CO)

K1	CO1	To keep in mind the basic principle and characteristics of Lasers
K2	CO2	To get the idea about the action of various types of Lasers, performance improvement and their applications
K3	CO3	To implement Laser in Non-linear optics
K4	CO4	To review the ideas and concepts of Laser Spectroscopy

Syllabus

Unit	Content	Hrs
I	**BASIC PRINCIPLES OF LASERS** Energy levels - Thermal equilibrium - Einstein's prediction – Einstein Relations - Condition for large Stimulated emissions - Condition for light amplification - Line shape function - Population inversion - Pumping methods – Active medium – Metastable states – Pumping schemes – Optical Resonator and its Action - Line broadening - Cavity configurations - Modes - *Laser rate equations for three & four level systems*	13
II	**LASER CHARACTERISTICS** Spatial & Temporal coherence - Directionality - Monochromaticity - Intensity **TYPES OF LASERS** Ruby laser - Nd YAG laser - Helium Neon laser - Carbondioxide laser - Semiconductor diode laser - Excimer laser - Dye laser - Chemical laser - X ray laser - Free electron laser - Fiber laser - Color center laser	13
III	**PERFORMANCE IMPROVEMENT OF LASER** Q- factor - Methods of Q switching – Cavity dumping – Techniques for mode locking - Laser amplifiers - Distributed feedback laser **APPLICATIONS OF LASER** Material processing: Surface treatments – Drilling –Cutting - Welding - Laser in Nuclear energy: Isotope separation - Laser in medicine - Laser in Defence – Holography.	13
IV	**NON-LINEAR OPTICS** Harmonic generation - Second harmonic generation - Phase matching - Third harmonic generation - Optical mixing - Parametric generation of light - Self focusing of light **MULTIPHOTON PROCESSES** Multi quantum Photo electric effect – Two photon processes (Experiments) - Three photon processes - Second harmonic generation - Parametric generation - Parametric light Oscillator - Frequency up conversion - Phase conjugate optics	13
V	**LASER SPECTROSCOPY** Rayleigh and Raman scattering - Stimulated Raman effect - Hyper Raman effect (Classical treatment) - Coherent Anti Stokes Raman Scattering - Spin flip Raman Laser - Photo acoustic Raman Spectroscopy – Brillouin scattering - Saturation absorption Spectroscopy - Doppler free two photon Spectroscopy – Modulation of an electron wave by a light wave – *Laser induced collision processes*	13
Total contact hours		65

- *Italic font denotes self study*

Additional activities

Seminar, Assignment, Experience discussion, PPT

Text Books

- Avadhanulu M.N. (2001). *Lasers Theory And Applications*. S.Chand and Company Ltd, New Delhi, (Units I – III).
- Laud B.B. (2001). *Lasers And Nonlinear Optics*. 2nd Edition, New age international private Ltd, New Delhi, (Units III - V).

Reference Books

- William T. Silfvast, (1998). *Laser Fundamentals.* (Cambridge University Press), First South Asian paperback Edition.
- Ghatak, Thyagarajan, *Lasers Theory And Applications.* Macmillan India Ltd.
- Ralf Menzel, (2001). *Photonics.* Springer International Edition.
- Abbi S.C. Ahmad S.A. (2001). *Non Linear Optics And Laser Spectroscopy*. Narosa publishing house, Narosa.

Mapping

PSO/CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	M	H	H
CO2	H	H	M	H	H
CO3	M	H	H	H	M
CO4	H	M	H	M	H

H – High; M – Medium; L – Low

Designed by	Verified by HOD	Checked by CDC	Approved by COE
Name: Dr.M.Karthika Signature: 	Name: Dr.V.Sathyabama Signature:	Name: Mr. K. Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme Code:	MSC	**Programme Title:**	Master of Science	
Course Code:	20PPS413	**Title**	**Batch:**	2020-2022
		Core XIII: Nuclear & Particle Physics	**Semester:**	IV
Hrs/Week:	5		**Credits:**	4

Course Objective

- To study the nuclear structure and properties of nuclei through nuclear models.

Course outcomes

K1	CO1	Understand the basic properties and structure of nucleus and nuclear reactions
K2	CO2	Analyze the properties and significance of stable nucleus through different types of nuclear models
K3	CO3	Elucidate the latest development in the classification of elementary particles like quarks, Higgs bosons
K4	CO4	Develop skills in solving problems in nuclear physics and pave a way to research in nuclear physics

Syllabus

Unit	Content	Hrs
I	**TWO BODY PROBLEM AND NUCLEAR FORCES** Deutron - Properties - Ground state of Deutron –Deutron Problem- Neutron Proton scattering at low energies - Scattering length and effective range - Spin dependence of n p forces - Tensor forces –Interpretation of high energy nucleon – nucleon scattering - Exchange forces - Nuclear forces - Properties of nuclear forces - Yukawa theory of nuclear forces	13
II	**NUCLEAR MODELS** Liquid drop model - Weizacker semi empirical mass formula - Shell model - Magic numbers - Magnetic moments and the Shell model - Prediction of angular momenta of nuclear ground states by Shell model - Collective model - Vibrational and Rotational states - *Elementary ideas of Unified and Superconductivity model*	13
III	**NUCLEAR DISINTEGRATION** Law of radioactive decay - Alpha ray emission - Gamow's theory of alpha decay - Alpha ray energies and fine structure - Alpha disintegration energy - Beta decay - Fermi's theory of beta decay - Fermi and G.T Selection rules - Parity in beta decay - Helicity - Electron capture - Gamma decay - Theory of angular correlation of successive radiation - Internal conversion - Angular momentum and Parity of excited levels	13
IV	**NUCLEAR FISSION AND FUSION REACTORS** Fission and Nuclear structure - Bohr Wheeler's theory – Classification of neutrons according to energy-energetics of fission –Controlled fission reactions – four factor formula - Fission reactors - Radioactive fission products - A natural fission reactor - Basic fusion processes - Characteristics of fusion - Solar fusion - Controlled fusion reactors – Nuclear reactions: Compound nuclear reactions – direct reactions	13
V	**ELEMENTARY PARTICLES** Fundamental forces in nature –positron and other antiparticles – meson and beginning of particle physics-General classification of Elementary particles - Conservation law – strange particle and strangeness – production of elementary particles and measurement of particle	13

	properties – Eight fold way –CPT invariance - Gellmann Okuba mass formula for Baryons – Quark : Original quark model, charm and other developments – Colored Quarks (Quantum Chromodynamics) – Experimental evidence for quarks- Explanation of nuclear force in term of quarks – Electroweak theory and standard model – Grand unification theory and super symmetry – String theory – Higgis boson	
Total contact hours		65

- *Italic font denotes self study*

Additional activities

Seminar, Assignment, Experience discussion, PPT

Text Books

- Tayal D.C. (2008). *Nuclear Physics*. 5th edition, Himalaya Publishing house,Mumbai, (Units I - IV).
- Pandya M.L. Yadav R.P.S. (1989). *Elements Of Nuclear Physics*. 5th Edition, Kedar Nath Ram Nath, Meerut,(Units I - IV).
- Atam P.Arya, (1974). *Elementary Modern Physics*. Addison - Wesley Publishing Co, (Units III & IV).
- Raymond A.Serway, Clement J.Moses, Curt A. Moyer, *Modern Physics*. 2nd Edition, Saunders College publishing (Harcourt Brace College publishers), (Units IV & V).

Reference Books

- Srivastava B.N. (1971). *Basic Nuclear Physics*. 12th edition, Pragathi Prakashan, Meerut.
- Kenneth S.Krane, (1988). *Introductory Nuclear Physics*. 2nd edition, John Wiley & sons, New York.

Mapping

PSO/CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	H	H	H
CO2	H	H	M	H	M
CO3	H	M	H	M	L
CO4	H	M	H	M	H

H – High; M – Medium; L – Low

Designed by	Verified by HOD	Checked by CDC	Approved by COE
Name: Dr. A. Suresh Kumar Signature:	Name: Dr.V.Sathyabama Signature:	Name: Mr. K. Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme Code:	MSC	**Programme Title:**	Master of Science	
Course Code:	20PPS414	**Title**	**Batch:**	2020-2022
		Core XIV: General Physics Lab II	**Semester:**	III & IV
Hrs/Week:	4		**Credits:**	5

Course objective

- To become familiar with the techniques of advanced General Experiments.

Course outcomes

K3	CO1	Become familiar with techniques of advanced general experiments
K4	CO2	Impart the broad knowledge of experimental methods and measurement techniques
K5	CO3	Familiarize analytical calculations

List of Experiments:

1. Copper Arc Spectra – CDS
2. λ, dλ of a Monochromatic source - Michelson's Interferometer
3. Zeeman Effect
4. Magnetic Susceptibility - Quincke's Method
5. Resistance of a Semiconductor – Four Probe Method
6. Iron Arc Spectra – CDS
7. Velocity of Sound in liquid- Ultrasonic Diffraction
8. Magnetic Susceptibility- Guoy' s Method
9. Magnetoresistance
10. BH Curve – Hysterisis - Standard Solenoid
11. Brass Arc Spectra - CDS
12. e/m - Millikan' s oil drop method
13. Polarimeter - Specific rotation of optically active substances
14. Determination of Planck' s constant and verification of inverse square law
15. Optical Fiber – Numerical aperture, Attenuation, Particle size and λ

Reference Books

- Worsnop, Flint, (1971). *Advanced Practical Physics*. Asia Publishing house.
- Singh S.P. (Vol. I & Vol. II), (1998). *Advanced Practical Physics.* 11th Edition Pragati Prakashan, Meerut.

Mapping

PSO/CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	H	M	H
CO2	M	H	H	H	H
CO3	M	H	H	H	H

H – High; M – Medium; L – Low

Designed by	Verified by HOD	Checked by CDC	Approved by COE
Name: Ms. N.Revathi Signature:	Name: Dr.V.Sathyabama Signature:	Name: Mr. K. Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme Code:	MSC	Programme Title:	Master of Science	
Course Code:	20PPS415	Title	Batch:	2020-2022
		Core XV: Electronics Lab II	Semester:	III & IV
Hrs/Week:	4		Credits:	5

Course Objective

- To know the action and applications of operational amplifier, and to become familiarize with 8085 microprocessor

Course outcomes

K3	CO1	Gain knowledge and understanding of the components and equipments
K4	CO2	Design analog circuits, make measurements, analyze and interpret the experimental data.
K5	CO3	Use the 8085 microprocessor for interfacing devices.

List of Experiments:

1. Parameters of Operational amplifier
2. Inverting, Non Inverting, Differential amplifier - Op Amp
3. Schmitt trigger, Scale changer, Phase changer - Op Amp
4. Constant current source - Op Amp
5. Microprocessor - Addition, Subtraction, Multiplication, Division & Conversion of Number systems
6. Simple and Regenerative Comparators – Op Amp
7. Digital to Analog converter - Op Amp
8. Adder, Subtractor, Integrator and Differentiator- Op Amp
9. Low pass, Band pass & High pass filters - Op Amp
10. Microprocessor - Interfacing I
11. Window Detector – Op Amp
12. Analog to Digital converter - Op Amp
13. Solving first order simultaneous equations of two variables- Op Amp
14. Function Generator - Op Amp
15. Microprocessor - Interfacing II

Reference Books

- Paul B. Zbar, Joseph Sloop, (1983). *Electricity & Electronics Fundamentals A Text-Lab Manual.* McGraw Hill, New Delhi.
- Paul B.Zbar, Malvino, Miller, (1997). *Electronics: A Text- Lab Manual.* Mc.Graw Hill, New Delhi.
- Woollard G. (1984). *Practical Electronics*. 2nd Edition, McGraw Hill, New Delhi.
- Subramaniyan S.V. (1983). *Experiments In Electronics*. Macmillan India Ltd.
- Gayakwad, (1988). *Operational Amplifier And Linear Integrated Systems*. 2nd Edition, Prentice hall of India pvt Ltd, New Delhi.
- 8085 - μp Trainer kit Manual, Version 4.0 Microsystems Pvt Ltd.

Mapping

PSO/CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	M	H	H	M
CO2	H	L	M	L	H
CO3	M	H	M	M	H

S – Strong; H – High; M – Medium; L – Low

Designed by	Verified by HOD	Checked by CDC	Approved by COE
Name:Dr.T.E.Manjulavalli Signature:	Name: Dr.V.Sathyabama Signature:	Name: Mr. K. Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature:

Programme Code:	MSC	Programme Title:	Master of Science	
Course Code:	20PPS416	Title	Batch:	2020-2022
		Core XVI: Computer Lab in C++	Semester:	IV
Hrs/Week:	2		Credits:	3

Course Objective

- To acquire basic knowledge in object oriented programming

Course outcomes

K3	CO1	To understand the concepts and benefits of OOPs
K4	CO2	To analyze the functions of various C++ operators
K5	CO3	To apply the C++ language to solve problems in Physics.

List of Experiments:

1. Class implementation.
2. Arrays within a Class.
3. Static data members and member function.
4. Arrays of Objects
5. A function friendly to two classes.
6. Simple constructor.
7. Overloaded Constructors.
8. Implementation of Destructors.
9. Overloading Unary operator.
10. Overloading Binary operator using member and friend function.
11. Multiple inheritance.
12. Multilevel inheritance.
13. Virtual base class.
14. Pointers to derived objects.
15. Virtual functions.

Reference Books

- Balagurusamy E. (2004).*Object Oriented.Programming With C++*. Tata Mc Graw Hill Publication, New Delhi.
- Venugopal K.P. Rajkumar, Ravishankar T. (2001). *Mastering C++*. Tata Mc Graw Hill Publication, New Delhi.
- Ravichandran D. (2003). *Programming With C++*. Tata Mc Graw Hill Publication, New Delhi.

Mapping

PSO/CO	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	H	H	H	H	H
CO2	H	H	H	M	M
CO3	H	H	H	H	H

H – High; M – Medium; L – Low

Designed by	Verified by HOD	Checked by CDC	Approved by COE
Name: Ms.V.Yasodha Mahalakshmi Signature: 	Name: Dr.V.Sathyabama Signature:	Name: Mr. K. Srinivasan Signature:	Name: Dr.R.Muthukumaran Signature: