Programme Code:	M.Sc. PHY			**Programme Title:**	Master of Physics	
Course Code:	22PPS101			**Title**	**Batch:**	2022– 2024
				Core I: Mathematical Physics	**Semester:**	I
Lecture Hrs./Week or Practical Hrs./Week	5	**Tutorial Hrs./Sem.**	-		**Credits:**	4

Course Objective

To learn the mathematical concepts and tools required to solve the problems related to physics and to develop the skills essential for solving advanced problems in theoretical physics

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the basic elements of complex analysis, important differential and integral theorems, Fourier and Laplace transforms.	K1 / K2
CO2	Apply the mathematical skills to solve quantitative problems related to the applications of physics	K3
CO3	Analyze the problems in various domains of physics to choose appropriate method of special differential equations and special integrals	K4
CO4	Evaluate the complicated differentials and integrals using special functions such as Legendre, Bessel, Hermite, beta and gamma functions	K5
CO5	Formulating different mathematical methods and physical laws in terms of complex analysis and tensors with coordinate transforms	K6

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	H	H	-	-	H	-	H	-
CO2	M	H	-	-	H	-	H	-
CO3	-	M	H	M	M	-	M	M
CO4	-	-	L	H	-	L	-	H
CO5	-	-	-	M	-	M	-	H

H – High; M – Medium; L – Low

MathematicalPhysics

Units	Content	Hrs
Unit I	**SPECIAL FUNCTIONS** Legendre differential equations and Legendre functions - Generating function of Legendre polynomial - Orthogonal properties of Legendre's polynomials - Recurrence formulae for Pn(x) - Bessel's differential equations: Bessel's functions of first kind - To solve J1/2(x), J-1/2(x), J3/2(x) and J-3/2(x) - Recurrence formulae for Jn(x) - Generating function of Jn(x) - Hermite differential equation & Hermite polynomials - Generating function of Hermite polynomials - Recurrence formulae for Hermite polynomials	13
Unit 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
Unit III	**PARTIAL DIFFERENTIAL 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
Unit 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
Unit V	**TENSORS, BETA AND GAMMA FUNCTIONS** n- dimensional space- Superscripts and Subscripts- Transformation of co-ordinates – Indicial convention-Summation convention – Dummy and real indices -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 Hrs	**65**

- *Italic font denotes self-study*

Pedagogy and Assessment Methods:

Seminar, Power Point Presentation, Chalk and talk, Quiz, Assignments, Group Task.

Text Book

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Satyaprakash	Mathematical Physics with classical mechanics	S Chand and Co Ltd, New Delhi	2013

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Gupta B.D.	Mathematical Physics	Vikas publication house, Noida, U.P	2001 (Reprint)
2	Louis A.Pipes & Lawrence R. Harvill	Applied Mathematics For Engineers & Physicsts	McGraw Hill Ltd, New Delhi.	1970
3	H.K. Dass& Rama Verma	Mathematical Physics	PHI Learning Pvt. Ltd., New Delhi	2016
4	**Related online contents [MOOC, SWAYAM, NPTEL, Websites etc]** https://nptel.ac.in/courses/115/106/115106086/ https://nptel.ac.in/courses/115/103/115103036/ https://nptel.ac.in/courses/115/106/115106086/ https://nptel.ac.in/courses/115/103/115103036/			

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Programme Code:	M.Sc.PHY			**Programme Title:**	Master of Physics	
Course Code:	22PPS102			**Title**	**Batch:**	2022 – 2024
				Core II: Classical Mechanics	**Semester:**	I
Lecture Hrs./Week or Practical Hrs./Week	5	**Tutorial Hrs./Sem.**	-		**Credits:**	4

Course Objective

To gain knowledge and understanding of lagrangian and Hamiltonian formulations of mechanics and to applythem to simple systems.

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the relation between symmetry operation and classical conservation laws	K1
CO2	Get clear understanding of recent intricate theories of modern physics	K2
CO3	Tackle the new problem and apply the techniques of classical mechanics to far-flung reaches of science	K3
CO4	Provide smooth transition from traditional techniques to rapidly growing area of non-linear dynamics and chaos	K4
CO5	Learn many concepts and key points which will also be used in other subjects of physics.	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	H	H	H	H	H	H	H	M
CO2	H	M	H	H	M	M	H	H
CO3	M	H	H	M	H	M	H	H
CO4	H	H	H	M	H	H	H	H
CO5	H	H	H	H	H	M	H	H

H–High;M– Medium;L–Low

Classical Mechanics

Units	Content	Hrs
Unit 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 - Atwood's machine - Double pendulum - *Conservation theorems: Cyclic coordinates - Conservation of Linear momentum - Conservation of energy*	13
Unit 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
Unit 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
UnitIV	**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
Unit 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 Hrs	**65**

- *Italic font denotes self-study*

Pedagogy and Assessment Methods:

Seminar, PowerPoint Presentation, Chalkandtalk, Quiz, Assignments, GroupTask.

TextBook

S.NO	AUTHOR	TITLE OF THEBOOK	PUBLISHERS \EDITION	YEAR OFPUBLICATION
1	Herbert Goldstein	Classical Mechanics	Addison Wesley Publishing Company	2001
2	Gupta S.L. Kumar V. Sharma R.C.	Classical Mechanics	PragatiPrakashan, Meeret	2010
3	Laxmanan M. Rajasekar S.	Nonlinear Dynamics	Springer - Verlag, Distributors: Prism Books Pvt Ltd, Berlin	1978

ReferenceBooks

S.NO	AUTHOR	TITLE OF THEBOOK	PUBLISHERS \EDITION	YEAR OFPUBLICATION
1	Rana N.C. Joag P.S.	Classical Mechanics	Tata McGraw Hill, New Delhi	2001
2	**Related online contents [MOOC, SWAYAM, NPTEL, Websites etc]** https://nptel.ac.in/courses/122/106/122106027/ https://ocw.mit.edu/courses/physics/8-09-classical-mechanics-iii-fall-2014/lecture-notes/			

Designed by	Verified by HOD	Checked by CDC	Approved by COE
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Programme Code:	M.Sc. PHY			**Programme Title:**	Master of Physics	
Course Code:	22PPS103			**Title**	**Batch:**	2022 – 2024
				Core III: Statistical Mechanics	**Semester:**	I
Lecture Hrs./Week or Practical Hrs./Week	5	**Tutorial Hrs./Sem.**	-		**Credits:**	4

Course Objective

To recognize the properties of macroscopic and microscopic systems with the knowledge of the properties of individual particles using classical and quantum statistics

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the connection between concepts of statistical mechanics and thermodynamics	K1 / K2
CO2	Apply the theories of statistical mechanics to the calculation of macroscopic properties resulting from microscopic models	K3
CO3	Identify the strength and limitations of the models used and be able to compare different microscopic models	K4
CO4	Attain an analytic ability to solve problems relevant to statistical mechanics	K5
CO5	Formulate statistical models of more realistic systems in statistical physics and other core areas of physics	K6

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	H	H	-	-	H	-	H	-
CO2	M	H	-	-	H	-	H	L
CO3	M	M	H	L	M	-	M	M
CO4	-	-	L	M	-	L	L	H
CO5	-	-	-	M	-	M	-	H

H – High; M – Medium; L – Low

Statistical Mechanics

Units	Content	Hrs
Unit 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 – Division of phase space into cells - 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
Unit II	**CLASSICAL STATISTICS** Microstates and Macro states –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
Unit 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
Unit 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 Para magnetism – *White dwarfs*	13
Unit V	**TRANSPORT PROPERTIES** 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 Hrs	**65**

- *Italic font denotes self-study*

Pedagogy and Assessment Methods:

Seminar, Power Point Presentation, Chalk and talk, Quiz, Assignments, Group Task.

Text Book

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Gupta, Kumar	Statistical Mechanics	Pragati Prakasahan Meerut	2003

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Agarwal K. Eisner	Statistical Mechanics	New Age International Publishers, New Delhi	1998
2	B.B. Laud	Fundamentals of Statistical Mechanics	New age International Publishers	2011
3	**Related online contents [MOOC, SWAYAM, NPTEL, Websites etc]** https://nptel.ac.in/courses/115/106/115106111/ https://ocw.mit.edu/courses/physics/8-333-statistical-mechanics-i-statistical-mechanics-of-particles-fall-2013/lecture-notes/			

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Programme Code:	M.Sc. PHY			**Programme Title:**	Master of Science	
Course Code:	22PPS1E1			**Title**	**Batch:**	2022 – 2024
				Core Elective I - Applied Electronics	**Semester:**	I
Lecture Hrs./Week	5	**Tutorial Hrs./Sem.**	-		**Credits:**	5

Course Objective

To understand the action of semiconductor devices and develop the concepts in the frontier areas of applied electronics

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Acquire the basic knowledge in semiconductor devices and their applications	K1/K2
CO2	Apply the electronic principles to develop circuits for different outputs	K3
CO3	Analyze the electronic circuit systems and trouble shoot them for proper working	K4
CO4	Explain the application of circuit configurations and identify type of electronic component used for proper operation of circuits	K5
CO5	Design oscillators and multi-vibrators with the acquired knowledge on electronics	K6

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	H	M	M	L	L	L	H	M
CO2	H	H	L	H	H	M	H	H
CO3	H	H	L	M	M	M	M	H
CO4	H	H	M	H	H	M	H	H
CO5	H	H	L	H	H	H	M	M

H – High; M – Medium; L – Low

Applied Electronics

Units	Content	Hrs
Unit 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
Unit 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
Unit 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
Unit 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
Unit 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 **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	13
	Total Contact Hrs	**65**

- *Italic font denotes self-study*

Pedagogy and Assessment Methods

Chalk and Talk lectures, Group Discussion, Seminar, Interaction, power point presentation

Text Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Norman Lurch	Fundamentals Of Electronics	John Wiley & Sons, New York	1981
2	Swaminathan Mathu	Electronics Circuits And Systems	Howard W.Sams & Co	1985
3	Endel Uiga	Optoelectronics	Prentice Hall International Editions, New York	1995

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Salivahanan S. Suresh kumar N. Vallavaraj A.	Electronic Devices & Circuits	Tata McGraw Hill Publishing Company Limited, New Delhi	2003
2	Robert F.Coughilin	Pearson Education Inc, New Delhi	Operational Amplifiers & Linear Integrated Circuits	2001
3	Chin Lin Chen	Elements Of Optoelectronics And Fiber Optics	A Time Mirror Higher ducation Group, Inc. company	1996
4	Wilson J. Hawkes J.F.B.	Optoelectronics – An Introduction	Prentice Hall, New Delhi	1992
5	Related online contents [MOOC, SWAYAM, NPTEL, Websites etc] https://nptel.ac.in/courses/122/106/122106025/ https://nptel.ac.in/courses/117/103/117103063/ https://nptel.ac.in/courses/108/101/108101091/			

Designed by	Verified by HOD	Checked by CDC	Approved by COE
Name: Dr.A.G. Kannan Signature:	Name: Dr.T.E.Manjulavalli Signature:	Name: Mr. K.Srinivasan Signature:	Name: Dr. R. Manicka Chezian Signature:

Programme Code:	M.Sc. PHY			**Programme Title:**	Master of Science	
Course Code:	22PPS204			**Title**	**Batch:**	2022 – 2024
				Core IV: Foundation of Quantum Mechanics	**Semester:**	II
Lecture Hrs./Week	5	**Tutorial Hrs./Sem.**			**Credits:**	4

Course Objective

To understand the basic concepts and formalisms in Quantum mechanics and solve eigen value problems by applying approximation methods

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the core concepts and abstract formalism of quantum mechanics and the mathematical tools required to formulate problems	K1/K2
CO2	Apply the most appropriate approximation methods to obtain solution for 1D,3D Eigen value problem	K3
CO3	Analyze the role of various quantum mechanical phenomena e.g. angular momentum, scattering theory in modern physics and technology, Compare the properties, establish the relations between them, Interpret and validate the results	K4
CO4	Assimilate all the components of course and select a correct method to find solution for various problems of atomic and molecular dimensions	K5
CO5	Incorporate relevant tools and methodologies of the course to exhibit the skills to test the ideas and solve complexities	K6

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	H	M	H	H	L	L	H	M
CO2	H	H	H	M	M	M	H	M
CO3	H	H	H	M	M	M	M	H
CO4	H	H	H	H	H	M	M	H
CO5	H	H	H	H	H	H	M	M

H – High; M – Medium; L – Low

Quantum Mechanics I

Units	Content	Hrs
Unit I	**BASIC AND GENERAL FORMALISM OF QUANTUM MECHANICS** Schrodinger Equation: Generalization to three dimension, operator correspondence - Max Born physical interpretation of the wave function - Conservation of probability- Ehrenfest theorem - Linear vector space - basis function - Hilbert space - Eigen function and Eigen values - Self Adjoint operator - Schwartz inequality - Operators - Completeness and Normalization of eigenfunctions - Gram Schmidt orthogonalisation procedure - Postulates of Quantum mechanics - Matrix representation of an operator - Column representation of wave function - Normalization and orthogonality of wave function in Matrix form - Change of basis, Similarity and Unitary transformation - Dirac's Notation- Equations of Motion; Schrodinger, Heisenberg and Dirac representation.	13
Unit II	**APPLICATIONS OF QUANTUM MECHANICS** Schrodinger equation in Cartesian and Polar coordinates= Stationary states - one dimensional Systems-- potential step - potential barrier and well - concept of tunneling - linear harmonic oscillator using differential equation approach - operator approach - Infinite cubical box - concept of degeneracies- The rigid rotator with free axis -Eigen function for the rotator - Rigid rotator in a fixed plane - Three dimensional harmonic oscillator - The hydrogen atom: Equations and Solutions of angular and Radial part(φ, θ and R).	13
Unit III	**ANGULAR MOMENTUM AND IDENTICAL PARTICLES** Algebra of the angular momentum vector components - Ladder operators - Eigen value spectrum and Matrix representation - Angular momentum operator- Addition of two angular momenta and CG coefficients - Application to two electron systems - Parity operator, Symmetric and Antisymmetric wave functions - *Pauli's exclusion principle.*	13
Unit IV	**TIME INDEPENDENT PERTURBATION THEORY** Perturbation theory for a system with Non-degenerate energy Levels - effect of electric field on the ground state of Hydrogen (Stark effects in Hydrogen) - *Ground state of Helium* - Degenerate energy levels - Effect of electric field on n = 2 state of Hydrogen - Variation method - The Hellmann Feynman theorem - Estimation of Ground state of Helium - WKB approximation - Connection Formula -Validity -*Alpha emission.*	13
Unit V	**TIME DEPENDENT PERTURBATION** Schrodinger equation and general solution – Propagator- Alteration of Hamiltonian, transitions and sudden approximation - Perturbation solution for transition amplitude - First order perturbation - Transition to continuum states: Fermi Golden rule - Scattering of a particle by a potential	
	Total Contact Hrs	**65**

Pedagogy and Assessment Methods

Chalk and Talk lectures, Group Discussion, Seminar, Interaction, power point presentation

Text Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1				
2	Nouredine Zettili,	Quantum Mechanics,	John wiley and Sons Ltd,	2009
3	Aruldhas	Quantum Mechanics	Prentice Hall India Company Pvt Ltd, New Delhi	2014

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Mathews, Venkatesan,	A Text Book of Quantum Mechanics	Tata McGraw Hill Company Ltd, New Delhi.	2016
2	Atkins P.W.	Quantum Mechanics	Oxford University Press, Oxford	1983
3	Gupta, Kumar, Sharma	Quantum Mechanics	Pragathi Prakash Publications,Meerut	2018
4	Related online contents [MOOC, SWAYAM, NPTEL, Websites etc] **http://nptel.ac.in/courses/122/106/122106034/** **http://nptel.ac.in/courses/115/103/115103104/** **http://nptel.ac.in/courses/115/101/115101107/**			

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Name: Dr.T.E.Manjulavalli Signature:	Name: Dr.T.E.Manjulavalli Signature:	Name: Mr. K.Srinivasan Signature:	Name: Dr. R. Manicka Chezian Signature:

Programme Code:	M.Sc. PHY			**Programme Title:**	Master of Physics	
Course Code:	22PPS205			**Title**	**Batch:**	2022 – 2024
				Core V: Electromagnetic theory & Electrodynamics	**Semester:**	II
Lecture Hrs./Week or Practical Hrs./Week	5	**Tutorial Hrs./Sem.**	-		**Credits:**	4

Course Objective

To develop the basic knowledge about electromagnetic field and plasma physics

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Recollect the basic ideas about electric, magnetic fields	K1
CO2	Understand the applications of electromagnetic field	K2
CO3	Analyze incompletion of Ampere's law and completion of Maxwell's equation	K4
CO4	Enhanced skill in solving problems by applying electromagnetic field expressions	K5
CO5	Promote fundamental ideas of the unified electromagnetic theory which is present everywhere	K6

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	M	H	H	M	H	M	H	M
CO2	H	H	H	M	H	H	H	M
CO3	M	H	H	M	H	M	H	M
CO4	M	M	H	M	H	H	H	M
CO5	H	H	L	H	H	M	H	M

H – High; M – Medium; L – Low

Electromagnetictheory & Electrodynamics

Units	Content	Hrs
Unit I	**ELECTROSTATICS** 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 - Claussius Mossotti relation - Polarisation of polar molecules-Langevin equation-Debye relation and molecular structure - Boundary conditions - Image method **MAGNETOSTATICS** Current density - Ampere's law of force - Biot Savart law - Ampere's circuital law - Magnetic scalar and vector potential - Application to magnetic dipole	13
Unit 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
Unit 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
Unit 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
Unit V	**RELATIVISTIC ELECTRODYNAMICS 1** Four vectors and tensors - Transformation equations for **ρ** and **J** - Transformation equation for ***A*** and φ - Electromagnetic field tensor - Transformation equation for ***E*** and ***B*** - Covariance of Maxwell's equations : Four vector form & four tensor form – *Covariance and transformation law of Lorentz force*	13
	Total Contact Hrs	**65**

- *Italic font denotes self-study*

Pedagogy and Assessment Methods:

Seminar, Power Point Presentation, Chalk and talk, Quiz, Assignments, Group Task.

Text Book

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Chopra K.K. Agarwal G. C.	Electromagnetic Theory	K. Nath & Co, Meerut \ 5th edition	1989
2	Chen F.F.	Introduction To Plasma Physics And Controlled Fusion	Plenium press, Newyork \3rd edition	

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	David. J. Griffiths	Introduction To Electrodynamics	Prentice Hall of India Private Ltd, New Delhi\ 2nd edition	
2	Gupta Kumar Singh	Electrodynamics	Pragati Prakasam, Meerut\ 13th edition	1998
3	Sen S. N	Plasma Physics	Pragati Prakasam, Meerut \3rd edition	1999
4	**Related online contents [MOOC, SWAYAM, NPTEL, Websites etc]** https://nptel.ac.in/courses/122/106/122106034/ https://ocw.mit.edu/courses/physics/8-04-quantum-physics-i-spring-2016/lecture-notes/			

Designed by	Verified by HOD	Checked by CDC	Approved by COE
Name: Ms.N.Revathi Signature:	Name: Dr.T.E.Manjulavalli Signature:	Name: Mr. K.Srinivasan Signature:	Name: Dr. R. Manicka Chezian Signature:

Programme Code:	M.Sc. PHY			**Programme Title:**	Master of Science	
Course Code:	22PPS206			**Title**	**Batch:**	2022-2024
				Core VI: Condensed Matter Physics	**Semester:**	II
Lecture Hrs./Week or Practical Hrs./Week	5	**Tutorial Hrs./Sem.**	-		**Credits:**	4

Course Objective

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

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the depth information of crystalstructures	K2
CO2	Apply knowledge of crystallographic techniques to elucidate the various properties in thesolid-state physics	K3
CO3	Analyze the different properties like electric, magnetic and thermal and develop the skills for research	K4
CO4	Evaluate the possibility of superconductors in industry and medical applications	K5
CO5	Create new materials based on a fundamental understanding of their properties	K6

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	H	M	M	M	-	-	H	-
CO2	M	H	M	-	H	L	M	L
CO3	L	M	H	M	M	L	H	M
CO4	L	M	H	M	M	M	L	M
CO5	-	L	M	M	H	H	L	H

H-High; M-Medium; L-Low

Condensed Matter Physics

Units	Content	Hrs
Unit I	**GEOMETRY OF CRYSTALS:** Periodicity in crystal – choice of unite cell – Wigner-Seitz unit cell- Number of lattice points per unit cell – Bravais lattice (2D and 3D), Rational features of a crystal and Miller Indices- Inter planar spacing –Density of atoms in a crystal plane – SC,BCC, FCC and HCP , other cubic structure, Ionic bonding, Bond dissociation of NaCl molecule, Evaluation of Madelung constant for NaCl structure, Covalent bond, Metallic bonding, Vanderwalls bonding, Reciprocal lattice to SC,BCC and FCC lattice, Properties of Reciprocal lattice, X-ray Diffraction |Experiment- Powder crystal method-X-ray diffraction – Interpretation of Braggs equation –Ewald's Construction.- Point defect, line defect, dislocation and color centers (Basic ideas only)	13
Unit II	**LATTICE VIBRATIONS OF SOLIDS &THERMAL PROPERTIES** Dynamics of the chain of identical atoms- Dynamics of a diatomic Linear chain- Dynamics of identical atoms in three dimensions- Experimental measurements of dispersion relations – Anharmonicity and thermal expansion. Specific heat of solids- Classical model – Einstein model, Density of states – Debye model – Thermal Conductivity of solids – Thermal conductivity due to electrons – Thermal resistance of solids (Umklapp Process)	13
Unit III	**FREE ELECTRON THEORY AND BAND THEORY OF SOLIDS** Electron moving in a potential well (1D&3D), Density of states –Fermi Dirac statistics- Electronic specific heat – Electronic conductivity of metals, relaxation time and mean free path – Thermal conducitivty and electrical resistivity of metals - Hall Effect-Bloch thereom – Kronig Penney model – Construction of Brillouin zones – Effective mass of an electron- Conductors, Semiconductors and Insulators.	13
Unit IV	**FERRO ELECTRIC AND MAGNETIC PROPERTIES OF SOLIDS** Ferroelectric crystals – Properties of Rochelle salt and $BaTiO_3$ - Ferroelectric domain – Piezo-Pyro and Ferri electric properties of crystals –Langevin's classical theory of Diamagnetic and Paramagnetic- Quantum theory of Paramagnetism – Paramagnetism of free electrons – Weiss theory of ferromagnetism and Domain theory – Antiferromagnetism – Ferrimagnetism and Ferrites.	13
Unit V	**SUPERCONDUCTORS** Effect of magnetic field, Critical current – Meissner effect – Thermodynamics of superconducting transitions – origin of energy gap – isotope effect – London equation – London penetration depth – coherence length – Elements of BCS theory – flux quantization , Normal tunneling and Josephson effect – High temperature superconductors	13
	Total Contact Hrs	**65**

- *Italic font denotes self-study*

Pedagogy and Assessment Methods:

Seminar, Power Point Presentation, Chalk and talk, Quiz, Assignments, Group Task.

Text Book

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	M.A. Wahab	Structure and Properties of Materials (Unit I- V)	Narosa Publishing house- 3rd Edition	2006
2	Kittel C.	Introduction to Solid State Physics (Unit-I)	Revised 7th edition, John Wiley & sons, New York,	2004
3	Srivastava J.P	Elements of Solid State Physics (Unit-I)	6th Edition, Prentice hall of India, New Delhi,	2001
4	Singhal R.L.	Solid State Physics (Unit-II)	4th edition, Kedarnath Ramnath & Co, Meerut,	1989
5	Pillai S.O.	Solid State Physics (Units III - V)	4th Edition, New Age international (P) Ltd, NewDelhi,	2001

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Richard Christman J.	Fundamentals of Solid State Physics	1st Edition, Library of congress cataloguing.	1998
2	Decker A. J	Solid State Physics	1st Edition, Macmillan & Co, Madras	1963
3	**Related online contents [MOOC, SWAYAM, NPTEL, Websites etc]** https://youtube.com/playlist?list=PLFW6lRTa1g83HGEihgwcy7KeTLUuBu3WF https://youtube.com/playlist?list=PLbMVogVj5nJRjLrXp3kMtrIO8kZl1D1Jp https://youtube.com/playlist?list=PL090DAFDD7A36E27B https://youtube.com/playlist?list=PLgMDNELGJ1CYJka07lYfNgSgno3OES8Wt			

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Programme Code:	M.Sc. PHY			**Programme Title:**	Master of Science	
Course Code:	22PPS2E3			**Title**	**Batch:**	2022 – 2024
				Core Elective II: Electronic Communications and Cyber security	**Semester:**	II
Lecture Hrs./Week	5	**Tutorial Hrs./Sem.**			**Credits:**	4

Course Objective

To develop the scientific skills in the Electronic Communication Systems and Cyber Security

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the various modulation techniques and the generation of microwaves and concepts of internet cyber security	K1/K2
CO2	Apply the basic physical concepts in analog, pulse and digital communication	K3
CO3	Implement the modulation techniques in the communication systems	K4
CO4	Evaluate the critical problems in communication systems	K5
CO5	Create the new digital transmission circuits used to modulate the signals	K6

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	H	L	L	H	M	L	H	M
CO2	H	M	L	M	H	M	H	H
CO3	H	M	L	M	H	M	M	H
CO4	H	H	M	H	H	M	L	H
CO5	H	H	M	H	H	H	M	M

H – High; M – Medium; L – Low

Electronic Communications and Cyber Security

Units	Content	Hrs
Unit 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
Unit 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
Unit 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
Unit 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
Unit 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 Hrs	**65**

- *Italic font denotes self-study*

Pedagogy and Assessment Methods

Chalk and Talk lectures, Group Discussion, Seminar, Interaction, power pointpresentation

Text Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Swaminathan Madhu	Electronic Circuits and Systems	H.W.Sams	1985
2	Kennedy, Davis	Electronic Communication Systems	Tata McGraw-Hill, New Delhi	2002
3	Dennis Roddy, John Coolen	Electronic Communications	Prentice-Hall of India, New Delhi	2000
4	Preston Gralla	How The Internet Works	Ziff- Davis Press	1996
5	Chwan-Hwa (John) Wu, J. David Irwin	Computer Networks & Cyber Security	CRC Press	2016

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Louis E.Frenzel	Communication Electronics	Tata McGraw Hill Publishing Company Ltd, New Delhi	2001
2	Wayne Tomasi	Electronic Communication Systems	Pearson Education Asia, New Delhi	1998
3	Robert J. Schoenbeck	Electronic Communication Systems	Universal Book Stall	1992
4	Wayne Tomasi, Vincent F.Alisouskas	Telecommunications	Printice- Hall International, New Delhi	1988
4	Related online contents [MOOC, SWAYAM, NPTEL, Websites etc] https://nptel.ac.in/courses/117/101/117101051/ https://nptel.ac.in/courses/117/105/117105077/ https://nptel.ac.in/courses/106/106/106106129/ https://nptel.ac.in/courses/106/105/106105031/			

Designed by	Verified by HOD	Checked by CDC	Approved by COE
Name: Dr.A.G.Kannan Signature:	Name: Dr.T.E.Manjulavalli Signature:	Name: Mr. K.Srinivasan Signature:	Name: Dr. R. Manicka Chezian Signature:

Programme Code:	M.Sc. PHY			**Programme Title:**	Master of Physics	
Course Code:	22PPS2N1			**Title**	**Batch:**	2022 – 2024
				Non Major Elective: Non Conventional Energy Sources	**Semester:**	II
Lecture Hrs./Week or Practical Hrs./Week	1	**Tutorial Hrs./Sem.**	-		**Credits:**	2

Course Objective

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

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Recollect the applications of physics in real world	K1
CO2	Understand the principles of physics involving various natural and artificial process	K2
CO3	Recognize the need of non conventional energy sources	K3
CO4	Implement the basics laws of physics in the field of non conventional energy sources	K3
CO5	Analyze the efficiency of devices and instruments used in the production of energy	K4

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	H	M	L	-	-	-	M	-
CO2	H	H	-	H	M	M	-	M
CO3	-	-	-	M	-	M	M	-
CO4	M	H	L	H	H	-	-	M
CO5	-	-	M	H	M	-	M	M

H – High; M – Medium; L – Low

Non Conventional Energy Sources

Units	Content	Hrs
Unit 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
Unit II	**WIND ENERGY** Wind energy conversion – Site selection consideration – Basic components of a wind energy conversion system (WECS) – *Advantages and disadvantages of WECS.*	2
Unit III	**OCEAN ENERGY** Ocean thermal energy conversion (OTEC) – Methods of ocean thermal energy power generation – Closed cycle OTEC system – Open cycle OTEC system.	2
Unit 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
Unit 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 Hrs	**13**

- *Italic font denotes self-study*

Pedagogy and Assessment Methods:

Seminar, Power Point Presentation, Chalk and talk, Quiz, Assignments, Group Task.

Text Book

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	G.D.Rai	Non-Conventional Energy Sources	Khanna Publishers, Delhi	2002

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	G.D.Rai	Solar Energy Utilization	Khanna Publishers, Delhi \ 1st edition	1980
2	S.P. Sukhatme	Solar Energy Principles of Thermal Collection and Storage	Tata McGraw Hill, New Delhi \ 2st edition	2000

Designed by	Verified by HOD	Checked by CDC	Approved by COE
Name: Dr.A.G. Kannan Signature:	Name: Dr.T.E.Manjulavalli Signature:	Name: Mr. K.Srinivasan Signature:	Name: Dr. R. Manicka Chezian Signature:

Programme Code:	M.Sc. PHY			**Programme Title:**	Master of science	
Course Code:	22PPS2N2			**Title**	**Batch:**	2022-2024
				Non Major Elective: Biomedical Instrumentation	**Semester:**	II
Lecture Hrs./Week or Practical Hrs./Week	1	**Tutorial Hrs./Sem.**	-		**Credits:**	2

Course Objective

To apply knowledge of physics in the field of biomedical instrumentation

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Recollect the basics of physics related to biology	K1
CO2	Acquire the prior knowledge of fundamental concepts, functioning and applications of physiological devices.	K2
CO3	Implement the knowledge in the construction and operation of instruments	K3
CO4	Analyze the process of operation	K4
CO5	Evaluate the technologies and model used in the biomedical instrumentation.	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	H	M	-	L	-	-	M	-
CO2	H	M	-	H	M	-	M	-
CO3	M	-	L	M	L	-	-	M
CO4	-	-	-	M	M	L	-	L
CO5	-	L	M	H	M	L	M	-

H – High; M – Medium; L – Low

Biomedical Instrumentation

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

- *Italic font denotes self-study*

Pedagogy and Assessment Methods:

Seminar, Power Point Presentation, Chalk and talk, Quiz, Assignments, Group Task.

Text Book

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	M. Arumugam	Biomedical Instrumentation	Anuradha Agencies	2002

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	John G. Webster	Medical Instrumentation Application and Design	John Wiley and Sons, New York	2004

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Name: Dr.A.G. Kannan Signature:	Name: Dr.T.E.Manjulavalli Signature:	Name: Mr. K.Srinivasan Signature:	Name: Dr. R. Manicka Chezian Signature:

Programme Code:	M.Sc. PHY			**Programme Title:**	Master of Physics	
Course Code:	22PPS207			**Title**	**Batch:**	2022 – 2024
				Core VII: General Physics Lab I	**Semester:**	I & II
Lecture Hrs./Week or Practical Hrs./Week	4	**Tutorial Hrs./Sem.**	-		**Credits:**	4

Course Objective

To develop the skill to gain knowledge in experimental techniques

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand and familiarize with the basics of experimental physics	K1/K2
CO2	Apply the knowledge in performing the experiments	K3
CO3	Analyze the working of the apparatus	K4
CO4	Evaluate and compare the experimental results with theoretical values	K5
CO5	Design new experimental set up to validate the theory	K6

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	H	H	H	H	H	H	H	H
CO2	M	M	H	M	H	M	H	H
CO3	H	H	H	H	H	H	H	H
CO4	M	H	H	H	H	H	H	H
CO5	H	M	H	M	H	H	H	H

H – High; M – Medium; L – Low

General PhysicsLab I

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

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Worsnop, Flint	Advanced Practical Physics	Asia Publishing house	1971
2	Singh S.P.	Advanced Practical Physics	Pragati Prakashan	1998

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Programme Code:	M.Sc. PHY			**Programme Title:**	Master of Physics	
Course Code:	22PPS208			**Title**	**Batch:**	2022 – 2024
				Core VIII: Electronics Lab I	**Semester:**	I & II
Lecture Hrs./Week or Practical Hrs./Week	4	**Tutorial Hrs./Sem.**	-		**Credits:**	4

Course Objective

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

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Procure the knowledge of characteristics of semiconductor devices	K1/K2
CO2	Apply the basic principles of electronics to verify the various device characteristics	K3
CO3	Analyze the theory of transistors, capacitors, resistors and implement the knowledge with workable circiuts	K4
CO4	Troubleshoot the combinational circuits using digital IC's	K5
CO5	Develop the devices like regulated power supply by using the principles of electronics	K6

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	H	H	L	M	H	L	H	M
CO2	H	H	L	H	H	L	H	H
CO3	H	M	M	H	H	L	M	H
CO4	H	M	M	M	H	L	M	H
CO5	H	H	L	H	H	H	M	H

Electronics Lab I

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

Text Book

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Woollard G	Practical Electronics	McGraw Hill, New Delhi	2nd Edition 1984

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Paul B. Zbar, Joseph Sloop	Electricity & Electronics Fundamentals A Text-Lab Manual	McGraw Hill, New Delhi	1983
2	Paul B.Zbar, Malvino, Miller	Electronics: A Text- Lab Manual	Mc.Graw Hill, New Delhi	1997
3	Subramaniyan S.V.	Experiments In Electronics.	Macmillan India Ltd, New Delhi.	1983
4	Bhargowa N.N.	Basic Electronics and Linear Circuits.	McGraw Hill, New Delhi.	1984

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Programme Code:	M.Sc. PHY			**Programme Title:**	Master of Science	
Course Code:	22PPS309			**Title**	**Batch:**	2022 – 2024
				Core X: Advanced Quantum Mechanics	**Semester:**	III
Lecture Hrs./Week	5	**Tutorial Hrs./Sem.**			**Credits:**	4

Course Objective

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

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Demonstrate understanding of basic principles of quantum, concepts and terminology of Quantum mechanics and their applications to various physical and chemical problems and gain an insight in the quantum field theory	K1/K2
CO2	Apply the concepts of quantum mechanics to quantitatively predict the behavior of physicalSystems such as Atomic, Nuclear, Molecular, Solid state and statistical physics	K3
CO3	Analyze and apply the modern quantum mechanical methods for determining electronicstructure of molecules and atoms	K4
CO4	Integrate several components to find solution to the problems in Molecular and elementary particle physics by choosing an appropriate theoretical method	K5
CO5	Adopt systematic methodology and relevant tool to find solution to problems of modern physics, interpret the findings and communicate the results effectively	K6

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	H	M	H	H	L	L	H	M
CO2	H	H	H	M	M	M	H	M
CO3	H	H	H	M	M	M	M	H
CO4	H	H	H	H	H	M		H
CO5	H	H	H	H	H	H	M	M

H – High; M – Medium; L – Low

Quantum Mechanics II

Units	Content	Hrs
Unit I	**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
Unit II	**SEMI CLASSICAL THEORY OF RADIATION** Harmonic Perturbation - Absorption and Emission of Radiation : The electromagnetic Field - The Hamiltonian operator -Electric Dipole Approximation - Einstein's A and B coefficients - Selection rules - Rayleigh Scattering - Raman Scattering.	13
Unit III	**RELATIVISTIC QUANTUM MECHANICS I** Klein Gordon equation - Plane wave solutions - Position probability density and current density - Applications to the study of energy levels of electron in a coulomb field - Dirac equation - Probability and Current densities - Dirac matrices - Plane wave solutions for Dirac equation -Negative energy - Magnetic moment of the electron - Existence of electron spin - Spin-orbit energy - Dirac's equation of a central field force (H-Atom) - Solution of Dirac's equation of a central field force (H-Atom) - Hydrogen spectrum according to Dirac equation.	13
Unit 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
Unit 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 Hrs	**65**

Pedagogy and Assessment Methods:

Chalk and Talk lectures, Group Discussion, Seminar, Interaction, power pointpresentation

Text Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Mathews, Venkatesan	A Text Book of Quantum Mechanics	Tata McGraw Hill Company Ltd, New Delhi.	2016
2	Gupta, Kumar, Sharma	Quantum Mechanics	Pragathi Prakash Publications, Meerut	2018
3	Aruldhas	Quantum Mechanics	Prentice Hall India Company Pvt Ltd, New Delhi	2014
4	Satyaprakash	Advanced Quantum Mechanics	Kedar nath Ram Nath, Meerut \ Fifth revised edition	2017
5	Chatwal G.R., Anand S.K.	Quantum Mechanics	Himalaya Publishing Company, New Delhi	2011
6	Ira. N. Levine	Quantum Chemistry	Himalaya Publishing Company, New Delhi	2015

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Gupta S.L., GuptaI.D.	Advanced Quantum Theory And Fields	S Chand and Company Ltd, NewDelhi	2016
2	Atkins P.W.	Quantum Mechanics	Oxford University Press, Oxford	1983
3	Walter. A. Harrison	Applied Quantum Mechanics	Applied Publishers Ltd Mumbai	2000
4	Wu T.Y. Pauchy Hwang W.Y.	Relativistic Quantum Mechanics & Quantum Fields	Allied Publishers Ltd, NewDelhi	1991
5	Related online contents[MOOC, SWAYAM, NPTEL, Websites etc] http://nptel.ac.in/courses/115/103/115103104 http://nptel.ac.in/courses/115/106/115106065/			

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Name: Dr.T.E.Manjulavalli Signature:	Name: Dr.T.E.Manjulavalli Signature:	Name: Mr.K.Srinivasan Signature:	Name: Dr. R. Manicka Chezian Signature:

ProgrammeCode:	M.Sc.PHY			**Programme Title:**	Master of Physics	
CourseCode:	22PPS310			**Title**	**Batch:**	2022 – 2024
				Core IX: Molecular Spectroscopy	**Semester:**	III
LectureHrs./Week or PracticalHrs./Week	5	**TutorialHrs./Sem.**	-		**Credits:**	4

CourseObjective

To develop the skill to gain knowledge in group theory and different spectroscopic techniques

CourseOutcomes

Onthesuccessful completionofthecourse, studentswill beable to

CO Number	COStatement	Knowledge Level
CO1	Understand the symmetry of molecules and principle of different spectroscopic techniques	K1/K2
CO2	Apply symmetry operations to predict the point group of molecules	K3
CO3	Analyze the different motions of molecules and predict Microwave, IR and Raman activity	K4
CO4	Evaluate the conditions for resonance in NMR, ESR, NQR and Mossbauer Spectroscopy	K5
CO5	Create a character table and predict IR and Raman activity for new compounds	K6

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	H	H	H	H	M	H	H	H
CO2	H	H	H	H	M	H	H	H
CO3	H	H	H	M	M	H	H	H
CO4	H	M	M	H	H	H	H	H
CO5	H	H	H	H	H	H	H	H

H–High;M– Medium;L–Low

Molecular Spectroscopy

Units	Content	Hrs
Unit I	**MOLECULAR SYMMETRY & GROUP THEORY** Group - Group Multiplication table - Classes - Symmetry elements and Symmetry operations –Symmetry planes and reflections - Invertioncentre - 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
Unit 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
Unit 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
UnitIV	**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
Unit 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 quadrupoleresonance - Principle and theory of Mossbauer Effect - Mossbauer instrumentation - Applications - Electronic spectroscopy – Vibrational coarse structure of electronic spectra - Frank Condon principle - Fortratparabole	13
	TotalContactHrs	**65**

- *Italicfontdenotesself-study*

Pedagogy and Assessment Methods:

Seminar, PowerPoint Presentation, Chalk and talk, Quiz, Assignments, GroupTask.

Text Book

S.NO	AUTHOR	TITLE OF THEBOOK	PUBLISHERS \EDITION	YEAR OFPUBLICATION
1	Albert Cotton F	Chemical Application of Group Theory (Unit I)	Wiley Interscience	2008
2	Banwell C.N. Mccash E.M.	Fundamental Of Molecular Spectroscopy (Units II &III)	Tata McGraw Hill	2017
3	Aruldhas G	Molecular Structure and Spectroscopy (Units IV & V)	Prentice Hall of India Pvt Ltd	2007

Reference Books

S.NO	AUTHOR	TITLE OF THEBOOK	PUBLISHERS \EDITION	YEAR OFPUBLICATION
1	Barrow G.M	Introduction to Molecular Spectroscopy	Prentice Hall of India Pvt Ltd	1962
2	Chatwal and Anand	A Text Book Of Spectroscopy	Prentice Hall of India Pvt Ltd	2016
3	ManasChanda	Atomic Structure and The Chemical Bond	Tata McGraw Hill	2000
4	**Related online contents [MOOC, SWAYAM, NPTEL, Websites etc]** https://nptel.ac.in/courses/115/105/115105100/ https://onlinecourses.nptel.ac.in/noc20_cy31/preview			

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Programme Code:	M.Sc. PHY			**Programme Title:**	Master of Science	
Course Code:	22PPS3E5			**Title**	**Batch:**	2022 – 2024
				Core Elective III: Thin film & Nano science	**Semester:**	III
Lecture Hrs./Week	5	**Tutorial Hrs./Sem.**	-		**Credits:**	5

Course Objective

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

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the concepts of Growth process of Thin film materials and familiarize with the basics of Nanotechnology and Quantum structure	K1/K2
CO2	Apply the various methodologies to fabricate materials	K3
CO3	Categorize the materials according to their size	K4
CO4	Summarize the various properties of thin materials and nanomaterials using several characterization techniques	K5
CO5	Synthesis thin-film materials and nano-materials for several applications	K6

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	H	M	L	L	-	L	H	H
CO2	M	H	-	-	-	-	M	H
CO3	M	M	M	H	-	-	M	H
CO4	-	-	-	H	-	-	-	H
CO5	-	-	-	-	H	M	H	H

H – High; M – Medium; L – Low

Thin film & Nano science

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:** Conducting properties of metal, semiconductor and insulator films, Hall effect and Magneto resistance **Film Thickness Measurement:** Interferometry, Fringes of equal thickness (FET), Fringes of equal chromatic order (FECO), Step gauges, Ellipsometry, Multiple beam interferometry.	13
III	**Nanoscience** Introduction- Moore's laws- classification of nanostructures- quantum confinement in nanostructures- Electronic density of states- excitons- Influence of nanoscale dimension on properties: Structural properties, Thermal properties, chemical properties, Mechanical properties, Magnetic properties, Optical properties, Electronic properties, Biological systems- Metal nanoclusters- Semiconducting nanoparticles- **Carbon nanostructures**: Carbon nanoclusters-carbon nanotubes-properties	13
IV	**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 **Characterization:** XRD – SEM -TEM- EDAX-Particle size analyzer- IR and Raman spectroscopy-UV spectroscopy-Photo luminescence spectroscopy.	13
V	**Applications of Nanomaterials:** NEMS – MEMS - coulomb blockade effect – SET – QDLED- Quantum dot sensitized solar cell - Quantum dot laser - Quantum cascade laser – Carbon nanotube transistors - Silicon nanowire biosensor - drug delivery.	13
	Total contact hours	65

Pedagogy and Assessment Methods:

Seminar, Power Point Presentation, Chalk and talk, Quiz, Assignments, Group Task

Text Book

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Goswami A	Thin film fundamentals	New Age International	2006
2	L. T. Meissel and R. Glang	Hand book of Thin Film technology	McGraw -Hill	1978
3	Kasturi L Chopra	Thin film phenomena	McGraw -Hill	1979
4	Charles P. Poole, Frank J. Owens,	Introduction to Nanotechnology	John Wiley & Sons, New York	2011
5	Robert W.Kelsall, Ian W. Hamley, Mark Geoghegan	Nanoscale Science and Technology	John Wiley & Sons, New York	2005
6	Michael F. Ashby, Paulo J. Ferreira, Daniel L. Schodek	Nanomaterials, Nanotechnologies and an introduction for engineers and design architecture	Elsevier Science	2009
7	Guozhong CAO	Nano Structures and Nano Materials: Synthesis, Properties and Applications	Imperial College plus, London	2004

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Milton Ohring	Materials Science of Thin films	Academic Press	2001
2	Muralidharan V.S. Subramania A	Nanoscience and Technology	Ane Books Pvt Ltd – I Edition, New Delhi	
3	Masuo Hosokawa, Kiyoshi Nogi,Makio Naito, Toyokazu Yokoyama	Nanoparticle Technology Handbook	Elsevier Science	2007
4	Hari Singh Nalwa	Handbook of Nanostructured Nanotechnology	Academic Press Vol(1-5)	2000
5	**Related online contents [MOOC, SWAYAM, NPTEL, Websites etc]** http://www.ncpre.iitb.ac.in/slotbooking/SOP/62SOP.pdf https://en.wikipedia.org/wiki/Nanomaterials https://www.nano.gov/you/nanotechnology-benefits			

Designed by	Verified by HOD	Checked by CDC	Approved by COE
Name: Dr. S. Shanmuga Priya Signature:	Name: Dr.T.E.Manjulavalli Signature:	Name: Mr. K.Srinivasan Signature:	Name: Dr. R. Manicka Chezian Signature:

Programme Code:	M.Sc. PHY			**Programme Title:**	Master of Physics	
Course Code:	22VAD301			**Title**	**Batch:**	2022 – 2024
				Value Added Course: Python Programming	**Semester:**	III
Lecture Hrs./Week or Practical Hrs./Week	-	**Tutorial Hrs./Sem.**	-		**Credits:**	GRADE

Course Objective

To introduce Python programming to solve scientific and technological problems

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Acquire the knowledge to analyze the problem	K1 / K2
CO2	Plan to write the algorithm of a program with the knowledge of mathematical operators, logical operators, conditional and looping statements	K3
CO3	Analyze the problems in various domains of physics to write the program using python codes	K4
CO4	Explain clearly the importance of different function statements and pass the arguments between functions	K5
CO5	Device and compile the python programming for application in the field of science and technology	K6

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	M	M	M	H	H	L	H	M
CO2	M	H	M	L	H	L	H	H
CO3	L	M	H	M	M	M	M	M
CO4	M	L	L	H	H	H	M	H
CO5	L	M	L	M	H	H	M	H

H – High; M – Medium; L – Low

PythonProgramming

Units	Content	Hrs
Unit I	**Basics of Programming** Basis of programming– IDLE - variables and data types – strings – manipulating data – operators - syntax	10
Unit II	**Control Statements, Looping, File Handling** Control statements: if, if-else, nested if-else – loops (for, while); nested loops – break – continue – pass - text files – file handling and directories – - printing on screen – reading and writing of data in a file - opening and closing a file	10
Unit III	**Functions and Modules** Defining a function - Calling a function – Types of functions – Function arguments – python modules - Importing module – commonly used modules – writing and executing python program for few scientific problems	10
	Total Contact Hrs	30

Pedagogy and Assessment Methods:

Seminar, Power Point Presentation, Chalk and talk, Quiz, Assignments, Group Task.

Text Book

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Kenneth Lambert	Fundamentals of Python: First Programs	Course Technology, Cengage Learning	2012

Reference Book

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Rashi Gupta	Making Use of Python	Wiley Publishing, Inc., New York	2002
2	**Related online contents [MOOC, SWAYAM, NPTEL, Websites etc]** www.python.org			

Designed by	Verified by HOD	Checked by CDC	Approved by COE
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Programme Code:	M.Sc. PHY			**Programme Title:**	Master of Physics	
Course Code:	22PPS411			**Title**	**Batch:**	2022 – 2024
				Core XI: Lasers & Non-Linear Optics	**Semester:**	IV
Lecture Hrs./Week or Practical Hrs./Week	5	**Tutorial Hrs./Sem.**	-		**Credits:**	4

Course Objective

To develop the skill to gain knowledge in the basic principles of Laser and Non-linear optics

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the basic principle of laser and its interaction with matter	K1/K2
CO2	Apply the principle and demonstrate the working of different types of Lasers	K3
CO3	Analyze the performance of laser and improve the quality	K4
CO4	Evaluate the role of laser in nonlinear optics	K5
CO5	Design a Q-switched laser for nonlinear optical studies	K6

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	H	M	H	H	H	H	H	H
CO2	M	H	H	H	H	H	H	H
CO3	M	H	H	H	H	H	H	H
CO4	H	M	H	H	H	H	H	H
CO5	H	M	H	H	H	H	H	H

H – High; M – Medium; L – Low

Lasers& Non-Linear Optics

Units	Content	Hrs
Unit 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 - Laser rate equations : Three level laser - *Four level laser*	13
Unit 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
Unit 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 - Lasers in Nuclear energy: Isotope separation - Laser in medicine - Laser in Defence –Holography.	13
Unit 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 light Oscillator - Frequency up conversion - Phase conjugate optics	13
Unit 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 - Saturation absorption Spectroscopy - Doppler free two photon Spectroscopy – Multi-photon Ionization – Single Atom detection with Lasers *-Laser cooling and trapping of neutral atoms*	13
	Total Contact Hrs	**65**

- *Italic font denotes self-study*

Pedagogy and Assessment Methods:

Seminar, Power Point Presentation, Chalk and talk, Quiz, Assignments, Group Task.

Text Book

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Avadhanulu M.N	Lasers Theory And Applications (Units I - III)	S.Chand,	2001
2	Laud B.B	Lasers And Nonlinear Optics (Units III - V)	New age international private Ltd,	2011

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	William T. Silfvast	Laser Fundamentals	Cambridge University Press	2008
2	Ghatak, Thyagarajan	Lasers Fundamentals And Applications	Macmillan India Ltd	2019
3	Ralf Menzel	Photonics	Springer International Edition	2001
4	Abbi S.C. Ahmad S.A.	Non Linear Optics And Laser Spectroscopy.	Narosa publishing house	2001
5	**Related Online Contents [MOOC, SWAYAM, NPTEL, Websites etc.]** https://nptel.ac.in/courses/115/101/115101008/ https://spie.org/education/courses/coursedetail/SC047?f=InCompany https://ipenche.chania.teicrete.gr/an-introduction-to-laser-physics-and-systems/			

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Programme Code:	M.Sc. PHY			**Programme Title:**	Master of Science	
Course Code:	22PPS412			**Title**	**Batch:**	2022-2024
				Core XII: Nuclear & Particle Physics	**Semester:**	IV
Lecture Hrs./Week or Practical Hrs./Week	5	**Tutorial Hrs./Sem.**	-		**Credits:**	4

Course Objective

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

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Acquire basic knowledge on the properties, structure of nucleus and nuclear reactions	K1
CO2	Understand the properties and significance of stable nucleus through different types of nuclear models	K2
CO3	Apply the basic concepts in the classification of elementary particles like quarks, Higgs bosons	K3
CO4	Analyze problem solving skills in nuclear physics and pave a way to research in nuclear physics	K4
CO5	Evaluate the fundamental properties of elementary particles, as well as symmetries and the standard model	K5

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	H	M	L	-	M	-	H	-
CO2	H	M	L	-	M	-	M	-
CO3	L	H	M	L	H	-	M	L
CO4	-	M	H	M	M	L	L	M
CO5	-	M	H	H	L	M	-	H

H-High; M-Medium; L-Low

Nuclear & Particle Physics

Units	Content	Hrs
Unit I	**TWO BODY PROBLEM AND NUCLEAR FORCES** Deuteron - Properties - Ground state of Deuteron –Deuteron 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
Unit 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
Unit 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
Unit 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
Unit 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 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 – Higgs boson	13
	Total Contact Hrs	**65**

- *Italic font denotes self-study*

Pedagogy and Assessment Methods:

Seminar, Power Point Presentation, Chalk and talk, Quiz, Assignments, Group Task.

Text Book

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Tayal D.C.	Nuclear Physics (Units I - IV)	5th edition, Himalaya Publishing house, Mumbai,	2008
2	Pandya M.L. Yadav R.P.S.	Elements of Nuclear Physics, (Units I - IV)	5th Edition, Kedar Nath Ram Nath, Meerut	1989
3	Atam P.Arya,	Elementary Modern Physics (Units III & IV)	Addison - Wesley Publishing Co,	1974
4	Raymond A.Serway, Clement J.Moses, Curt A. Moyer	Modern Physics (Units IV & V)	2nd Edition, Saunders College publishing	-

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Srivastava B.N..	Basic Nuclear Physics	12th edition, Pragathi Prakashan, Meerut	1971
2	Kenneth S.Krane,	Introductory Nuclear Physics	2nd edition, John Wiley & sons, New York.	1988
3	**Related online contents [MOOC, SWAYAM, NPTEL, Websites etc]** https://nptel.ac.in/courses/115/104/115104043/ https://nptel.ac.in/courses/115/106/115106087/ https://nptel.ac.in/courses/115/103/115103101/			

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Name: Dr.A. Sureshkumar Signature:	Name: Dr.T.E.Manjulavalli Signature:	Name: Mr. K.Srinivasan Signature:	Name: Dr. R. Manicka Chezian Signature:

Programme Code:	M.Sc. PHY			**Programme Title:**	Master of science	
Course Code:	22PPS4E7			**Title**	**Batch:**	2022-2024
				Core Elective IV: Microprocessor & Object-Oriented Programming with C++	**Semester:**	IV
Lecture Hrs./Week or Practical Hrs./Week	5	**Tutorial Hrs./Sem.**	-		**Credits:**	5

Course Objective

- To acquire knowledge about microprocessor and object-oriented programs

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Acquire the knowledge of various instruction set of the Microprocessor Intel 8085	K1/K2
CO2	Apply the various C++ functional operators to build a secure program	K3
CO3	Analyze the method of interfacing of different programmable devices	K4
CO4	Solve problems in Physics based on Microprocessor and OOPS	K5
CO5	Design programs based on microprocessor for various applications like traffic light controller, stepper motor, A/D Converter and D/A Converter	K6

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	H	M	-	M	H	L	H	H
CO2	H	H	L	M	H	L	H	H
CO3	H	H	M	H	H	L	H	H
CO4	H	H	H	H	H	L	M	M
CO5	H	H	L	H	H	H	H	H

Microprocessor &Object-Oriented Programming with C++

Unit	Content	Hrs
I	**MICROPROCESSOR FUNDAMENTALS** 8085 Microprocessor pin diagram & functions - Architecture - Addressing modes - Instruction set - Data transfer instructions - Arithmetic instructions - Logical and Branch instructions - Stack, I/O & Machine control instructions – Subroutine, Conditional Call instructions and return instructions	13
II	**MICROPROCESSOR PROGRAMMING & MICROCONTROLLER** Steps involved in Microprocessor programming - Straight line programs -Looping programs - Mathematical programs **Microcontroller – Intel 8048 Series of microcontroller:** Architecture of 8048 Intel 8051 Series of microcontroller : Block diagram of 8051	13
III	**PRINCIPLES OF OBJECT-ORIENTED PROGRAMMING** Object Oriented Programming Paradigm - Basic concepts of Object Oriented Programming - Benefits of OOP **CLASSES & OBJECTS** Specifying a Class - Defining Member functions - Nesting of Member functions - Private Member functions - Arrays within a class - Memory allocation for objects- Static data members & Member functions - Arrays of Objects - Objects as function arguments - Friendly functions – Returning objects	13
IV	**CONSTRUCTORS & DESTRUCTORS** Constructors - Parameterized Constructors - Multiple Constructors in a Class - Copy Constructor -Dynamic Constructor- Destructors **OPERATOR OVERLOADING** Defining Operator Overloading - Overloading Unary & Binary Operators - Overloading Binary Operators using Friends - Rules for Overloading Operators	13
V	**INHERITANCE: EXTENDING CLASSES** Defining Derived classes - Single inheritance - Making a Private Member inheritable - Multilevel inheritance - Multiple inheritance - Hierarchical inheritance - Hybrid inheritance - Virtual base classes **POINTERS &VIRTUAL FUNCTIONS** Pointers to Objects - this Pointer - Pointers to Derived Classes - Virtual functions	13
Total contact hours		65

- *Italic font denotes self study*

Pedagogy and Assessment Methods:

Seminar, Power Point Presentation, Chalk and talk, Quiz, Assignments, Group Task.

Text Book

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Ramesh S.Gaonkar	Microprocessor Architecture Programming & Applications with the 8085	Penram International Publishing, New Delhi. (Unit I)	3rd Edition 1997
2	Roger L.Tokheim,	Microprocessor Fundamentals	Schaum's Outline Series, McGraw Hill Book Company, New Delhi, (Units I & II).	3rd Edition 1987
3	Badri Ram	Advanced microprocessors & interfacing	Mc Graw Hill Publication	20th reprint 2010
4	Balagurusamy E.	Object Oriented.Programming with C++.	Tata Mc Graw Hill Publication, New Delhi, (Units III – V).	2004

Reference Books

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Venugopal K.P. Rajkumar, Ravishankar T	Mastering C++	Tata Mc Graw Hill Publication, New Delhi.	2001
2	Ravichandran D	Programming With C++	Tata Mc Graw Hill Publication, New Delhi.	2003
3	**Related online contents [MOOC, SWAYAM, NPTEL, Websites etc]** https://nptel.ac.in/courses/108/105/108105102/ https://nptel.ac.in/courses/106/108/106108100/ https://nptel.ac.in/courses/108/103/108103157/			

Designed by	Verified by HOD	Checked by CDC	Approved by COE
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Programme Code:	M.Sc. PHY			**Programme Title:**	Master of Physics	
Course Code:	22PPS413			**Title**	**Batch:**	2022 – 2024
				Core XIII: General Physics Lab II	**Semester:**	III & IV
Lecture Hrs./Week or Practical Hrs./Week	4	**Tutorial Hrs./Sem.**	-		**Credits:**	5

Course Objective

To achieve a practical knowledge by applying the experimental methods to correlate with the Physics theory and analyze the experimental data

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Understand the theoretical concepts behind every experimental methods	K1 / K2
CO2	Apply the Knowledge of theory and analytical techniques to interpret experimental data	K3
CO3	Analyze the experimental results with mathematical concepts to obtain quantitative results	K4
CO4	Communicate the procedure and outcomes of an experiment	K5
CO5	Design new methodology to perform an experiment with the possible equipment in general physics laboratory	K6

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	M	M	-	-	-	-	H	-
CO2	M	M	-	-	H	M	H	M
CO3	-	L	M	M	M	M	M	H
CO4	-	-	L	H	H	H	M	H
CO5	-	-	L	M	H	H	-	H

H – High; M – Medium; L – Low

General PhysicsLab II

List of Experiments:

1. Copper Arc Spectra – CDS
2. λ, $d\lambda$ 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. Magneto-resistance
10. B-H Curve - Hysteresis - 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

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Worsnop, Flint	Advanced Practical Physics	Asia Publishing house	1971
2	Singh S.P.	Advanced Practical Physics	Pragati Prakashan, Meerut	1998

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Programme Code:	M.Sc. PHY			**Programme Title:**	Master of Science	
Course Code:	22PPS414			**Title**	**Batch:**	2022 – 2024
				Core XIV: Electronics Lab II	**Semester:**	III & IV
Lecture Hrs./Week	4	**Tutorial Hrs./Sem.**	-		**Credits:**	5

Course Objective

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

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Gain knowledge and understanding of IC'S and Microprocessor 8085	K2
CO2	Apply the theoretical knowledge and skill to design circuit, make measurements, analyze and interpret the experimental data.	K3
CO3	Enhance the logical thinking and ability by writing simple programmes using 8085 microprocessor and employ the technical expertise for interfacing devices	K4
CO4	Incorporate all the necessary tools and skills to devise practical circuits that perform desired operations	K5
CO5	Ability to Augment the present day requirements in industries and research fields by developing their own firm or fetch an employment as a Design engineer	K6

Mapping

PO /PSO / CO	PO1	PO2	PO3	PO4	PO5	PO6	PSO1	PSO2
CO1	H	H	M	M	M	L	H	H
CO2	H	H	H	H	M	M	H	H
CO3	H	H	H	H	M	M	M	L
CO4	H	H	H	H	H	H	M	M
CO5	H	H	H	H	H	H	M	H

H – High; M – Medium; L – Low

ElectronicsLab II

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

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS \ EDITION	YEAR OF PUBLICATION
1	Paul B. Zbar, Joseph Sloop	Electricity & Electronics Fundamentals A Text-Lab Manual	McGraw Hill, New Delhi	1983
2	Paul B. Zbar, Malvino, Miller	Electronics: A Text- Lab Manual	McGraw Hill, New Delhi	1997
3	Woollard G.	Practical Electronics	McGraw Hill, New Delhi	1984
4	Subramaniyan S.V.	Experiments In Electronics	Macmillan India Ltd	1983
5	Gayakwad	Operational Amplifier and Linear Integrated Systems	Prentice hall of India Pvt. Ltd, New Delhi	1988
6	-	8085 - μp Trainer kit Manual, Version 4.0	Microsystems Pvt. Ltd	-

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Programme Code:	M.Sc. PHY			**Programme Title:**	Master of Science	
Course Code:	22PPS415			**Title**	**Batch:**	2022 – 2024
				Core XV: Computer Lab in C++	**Semester:**	IV
Lecture Hrs./Week	2	**Tutorial Hrs./Sem.**	-		**Credits:**	3

Course Objective

To acquire basic knowledge in object oriented programming

Course Outcomes

On the successful completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	To remember the basic C++ language	K1 / K2
CO2	To apply the concepts and benefits of OOPs	K3
CO3	To analyze the functions of various C++ operators	K4
CO4	To evaluate the C++ language to solve problems in Physics	K5
CO5	To create the C++ language programs	K6

Mapping

PO/PSO / CO	PSO1	PSO2	PSO3	PSO4	PSO5	PO6	PSO1	PSO2
CO1	H	M	H	M	M	H	M	H
CO2	M	-	M	M	H	H	-	M
CO3	M	H	M	M	M	L	H	-
CO4	M	L	H	H	M	H	M	M
CO5	H	M	-	M	H	-	H	-

H – High; M – Medium; L – Low

Computer Lab in C++

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

S.NO	AUTHOR	TITLE OF THE BOOK	PUBLISHERS /EDITION	YEAR OF PUBLICATION
1	Balagurusamy E.	Object Oriented.Programming with C++.	Tata Mc Graw Hill Publication, New Delhi.	2004
2	Venugopal K.P. Rajkumar, Ravishankar T	Mastering C++	Tata Mc Graw Hill Publication, New Delhi	2001
3	Ravichandran D	Programming with C++	Tata Mc Graw Hill Publication, New Delhi.	2003

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Programme Code:	M.Sc. PHY			**Programme Title:**	Master of Physics	
Course Code:	22PPS416			**Title**	**Batch:**	2022 – 2024
				Core XVI: Project	**Semester:**	III & IV
Lecture Hrs./Week or Practical Hrs./Week	3	**Tutorial Hrs./Sem.**	-		**Credits:**	8

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