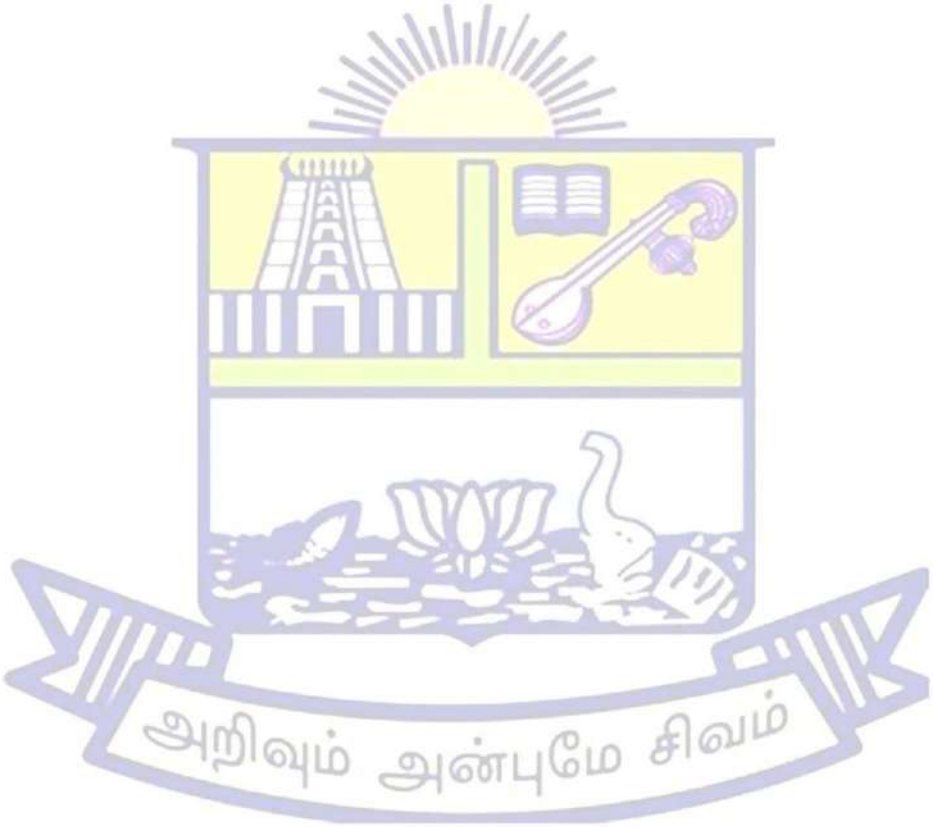
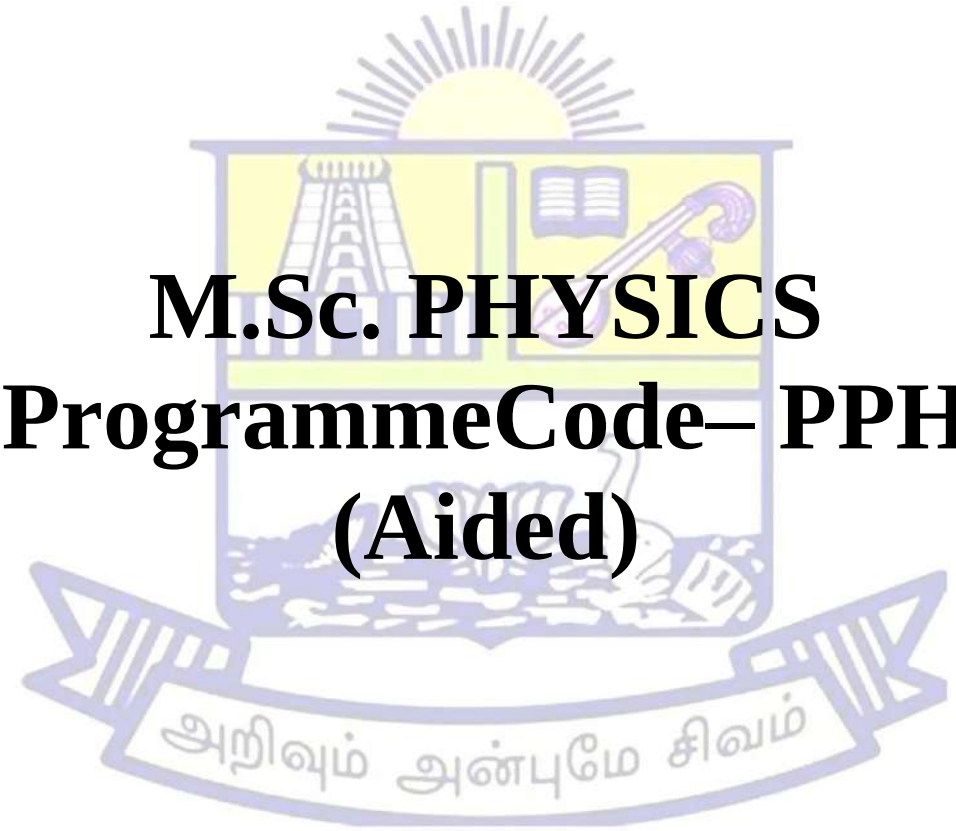
ThiagarajarCollege

(AnAutonomousInstitutionAffiliatedtoMaduraiKamarajUniversity)
Re-Accreditedwith'A++ 'Grade by NAAC

Academic Council Meeting (ACM)
June-2023



Department of Physics
M.Sc., Physics Syllabus
2023-2024



M.Sc. PHYSICS
ProgrammeCode– PPH
(Aided)

Programme outcome (PO) Master of Science (M.Sc.)

PO1 Knowledge

Acquire an overview of concepts, fundamentals and advancements of science across a range of fields, with in-depth knowledge in at least one area of study. Develop focused field knowledge and amalgamate knowledge across different disciplines.

PO2 Complementary skills

Students will be able to engage in critical investigation through principle approaches or methods and through effective information search and evaluation strategies. Employ highly developed conceptual, analytical, quantitative and technical skills and are adept with a range of technologies.

PO3 Applied learning

Students will be able to apply disciplinary or interdisciplinary learning across multiple contexts, integrating knowledge and practice. Recognize the need for information; effectively search for, evaluate, manage and apply that information in support of scientific investigation or scholarly debate

PO4 Communication

Communicate effectively on scientific achievements, basic concepts and recent developments with experts and with society at large. Able to comprehend and write reports, documents, make effective presentation by oral and/or written form.

PO5 Problem solving

Investigate, design and apply appropriate methods to solve problems in science, mathematics, technology and/or engineering.

PO6 Environment and sustainability

Understand the impact of the solutions in ethical, societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.

PO7 Teamwork, collaborative and management skills

Recognise the opportunities and contribute positively in collaborative scientific research. Engage in intellectual exchange of ideas with researchers of other disciplines to address important research issues.

THIAGARAJAR COLLEGE, MADURAI – 625 009

An Autonomous Institution Affiliated to Madurai kamaraj University
Re-Accredited with A++ Grade by NAAC
Ranked 18th in NIRF 2023

DEPARTMENT OF PHYSICS

LIGHT

Learn with focus
Innovate for a cause
be **G**rateful
be **H**umane
Transform dreams into reality

VISION

To provide an ambient environment for teaching and research in physics with focus on achieving academic excellence

MISSION

- To contribute to develop and sustain teaching and evaluation methods in physics learning in tune with emerging trends in science
- To constantly explore and enhance research potential among faculty and students to promote innovation
- To bridge the gap between curriculum-based learning and career readiness/employability of physics graduates
- To create a conscientious awareness among students about issues pertaining to welfare of society and environment

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

- The objectives of this programme is to equip/prepare students to

PEO1	A successful career in academia, government, industry, corporates or as an self-employed entrepreneur or as self-employed
PEO2	Continue to learn and advance in academia to undertake higher education with focus on research and development
PEO3	Communicate effectively by way of presenting a brief lecture on a specific topic in physics or writing scientific reports, projects, dissertations, and engage in debates and discussion.
PEO4	Acknowledge the importance of participation in co-curricular and extra-curricular activities to nurture and grow leadership skills, be socially sensitive to contemporary issues and play a constructive role in the welfare of the society.
PEO5	Be socially sensitive to contemporary issues and play a constructive role towards the welfare of the society and environment

PROGRAMME SPECIFIC OUTCOMES – M.Sc. PHYSICS

- On successful completion of M.Sc. Physics, the students will be able to

PSO1	Identify key concepts, principles and concepts of various major areas of theoretical and experimental research
PSO2	Comprehend fundamental concepts of physics through advanced laboratory experiments and qualify them to work in scientific and research laboratories.
PSO3	Explore problem solving skills and compete in state and national level competitive exams.
PSO4	Gain exposure to methods of research through a mandatory individual project work to be undertaken during the last semester.
PSO5	Plan and execute an experiment through careful observations, precise measurements, analysis,interpretation and effectively communicate the results by way of presenting a brief lecture on a science topic or writing scientific reports, projects, dissertation and engage in debates and discussions.

THIAGARAJAR COLLEGE, MADURAI – 9
(Re-accredited with 'A++' Grade by NAAC)
Department of Physics
M.Sc. Physics (w.e.f. 2023 batch onwards)
Programme Code :PPH

Semester – I

Course	Code	Subject	Contact hours per week	Credits	Total No. of hours allotted	Maximum Marks		Total
						CA	SE	
PART-A								
Core–1	PPH23CT11	Mathematical Physics	5	4	75	25	75	100
Core–2	PPH23CT12	Classical Mechanics and Relativity	5	4	75	25	75	100
Core Practical-1	PPH23CL11	Practical - I	5	4	75	25	75	100
Core Elective-1	PPH23ET11	Linear and Digital ICs and Applications	5	3	75	25	75	100
Core Elective - 2	PPH23ET12	Communication Electronics	5	3	75	25	75	100
PART-B								
AECC-1 Soft Skill	PPH23AT11	Ethics in Research and Publishing	2	2	30	25	75	100
SEC - 1	PPH23ST11	Computational Physics	3	2	45	25	75	100
			30	**22**	**450**	**175**	**525**	**700**

Semester – II

Course	Code	Subject	Contact hours per week	Credits	Total No. of hours allotted	Maximum Marks		Total
						CA	SE	
PART-A								
Core–3	PPH23CT21	Statistical Mechanics	5	4	75	25	75	100
Core–4	PPH23CT22	Quantum Mechanics – I	5	4	75	25	75	100
Core Practical-2	PPH23CL21	Practical – II	5	4	75	25	75	100
Core Elective-3	PPH23ET21	Characterization of Materials	5	3	75	25	75	100
Core Elective-4	PPH23ET22	Advanced Optics	5	3	75	25	75	100
PART-B								
AECC-2 Soft Skill	PPH23AT21	Soft Professional Skills	2	2	30	25	75	100
SEC - 2	PPH23ST21	Solar Photovoltaic Technology	3	2	45	25	75	100
			30	**22**	**450**	**175**	**525**	**700**

Thiagarajar College (Autonomous) Madurai – 625 009

Department of Physics

(For those joined M.Sc. Physics on or after June 2023)

PROGRAMME CODE: PPH

CourseCode	Course Title	Category	L	T	P	Credit
PPH23CT11	**MATHEMATICAL PHYSICS**	**Core-1**	**4**	1	–	**4**

Year	Semester	Int. Marks	Ext. Marks	Total
First	First	25	75	100

Preamble

- To equip students with the mathematical techniques needed for understanding theoretical treatment in different courses taught in their program
- To extend their manipulative skills to apply mathematical techniques in their fields
- To help students apply Mathematics in solving problems of Physics.

Prerequisite

Matrices, vectors, differentiation, integration, differential equations

Course Outcome

At the end of the course the student will be able to:

		K Level	Expected Proficiency %	Expectd Attainment%
CO1	Understand use of bra-ket vector notation and explain the meaning of complete orthonormal set of basis vectors, and transformations and be able to apply them	K1, K2	75	70
CO2	Able to understand analytic functions, do complex integration, by applying Cauchy Integral Formula. Able to compute many real integrals and infinite sums via complex integration.	**K2, K3**	**75**	**70**
CO3	Analyze characteristics of matrices and its different types, and the process of diagonalization.	**K4**	**75**	**70**
CO4	Solve equations using Laplace transform and analyze the Fourier transformations of different function, grasp how these transformations can speed up analysis and correlate	**K4, K5**	**75**	**70**

	their importance in technology			
CO5	To find the solutions for physical problems using linear differential equations and to solve boundary value problems using Green's function. Apply special functions in computation of solutions to real world problems	**K2, K5**	**75**	**70**
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate				

Mapping of Course Outcome with Programme Outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	S	M	M	M	L	M	S
CO2	M	S	M	M	S	S	L
CO3	S	S	S	L	S	L	M
CO4	M	L	S	M	S	S	L
CO5	S	S	S	L	S	M	M

Mapping of Course Outcome with Programme Specific Outcomes

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	L	S	L	M
CO2	L	M	L	L	S
CO3	L	L	S	–	M
CO4	M	S	S	L	M
CO5	L	M	L	S	M

Blooms Taxonomy: Assessment Patern

Bloom's category	**CA**		**End of Semester Marks**
	I Internal Marks	**II Internal Marks**	
Knowledge-K1	15% (9)	15% (9)	15% (20)
Understand-K2	15% (9)	15% (9)	15% (20)
Apply-K3	30% (18)	30% (18)	30% (40)
Analyze – K4	20% (12)	20% (12)	20% (25)
Evaluate – K5	20% (12)	20% (12)	20% (25)

MATHEMATICAL PHYSICS

Unit I Linear vector space

Basic concepts – Definitions- examples of vector space – Linear independence – Scalar product – Orthogonality – Gram-Schmidt orthogonalization procedure – Linear operators – Dual space – ket and bra notation – Orthogonal basis – Change of basis – Isomorphism of vector space – Projection operator –Eigen values and Eigen functions – Direct sum and invariant subspace – orthogonal transformations and rotation.

Unit II Complex Analysis

Review of Complex Numbers – de Moivre's theorem – Functions of a Complex Variable – Differentiability – Analytic functions – Harmonic Functions – Complex Integration – Contour Integration, Cauchy – Riemann conditions – Singular points – Cauchy's Integral Theorem and integral Formula – Taylor's Series – Laurent's Expansion – Zeros and poles – Residue theorem and its Application.

Unit III Matrices

Types of Matrices and their properties, Rank of a Matrix – Conjugate of a matrix – Adjoint of a matrix – Inverse of a matrix –Hermitian and Unitary Matrices – Trace of a matrix – Transformation of matrices – Characteristic equation – Eigen values and Eigen vectors –Cayley-Hamilton theorem – Diagonalization.

Unit IV Fourier transforms and Laplace transforms

Definitions – Fourier transform and its inverse – Transform of Gaussian function and Dirac delta function – Fourier transform of derivatives – Cosine and sine transforms – Convolution theorem. Application: Diffusion equation: Flow of heat in an infinite and in a semi-infinite medium – Wave equation: Vibration of an infinite string and of a semi-infinite string.

Laplace transform and its inverse – Transforms of derivatives and integrals – Differentiation and integration of transforms – Dirac delta functions – Application – Laplace equation: Potential problem in a semi-infinite strip.

Unit V Differential equations

Second order differential equation – Sturm-Liouville's theory – Series solution with simple examples – Hermite polynomials – Generating function – Orthogonality properties – Recurrence relations – Legendre polynomials – Generating function – Rodrigue formula – Orthogonality properties -– Dirac delta function – One dimensional Green's function and Reciprocity theorem – Sturm-Liouville's type equation in one dimension & their Green's function.

Unit VI Professional components

Expert Lectures, Online Seminars – Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism

Text Books

1. Arfken, G. and Weber, H.J. (2012): *Mathematical Methods for Physicists – A Comprehensive Guide* (7th ed.), Academic press.
2. Chattopadhyay, P.K. (2013): *Mathematical Physics* (2nd ed.), New Age International Pvt. Ltd.
3. Joshi, A.W. (2017): *Matrices and Tensors in Physics*, (4th ed.), New Age International Pvt. Ltd.
4. Gupta, B.D. (2009): *Mathematical Physics* (4thed.), Vikas Publishing House, New Delhi.
5. Dass, H.K. and Verma, R. (2014): *Mathematical Physics*, (7th ed.), S. Chand & Co. Pvt. Ltd., New Delhi.

Reference Books

1. E. Kreyszig, E. (1983): *Advanced Engineering Mathematics*, Wiley Eastern, New Delhi,
2. Zill, D.G. and Cullen, M.R. (2006): *Advanced Engineering Mathematics*, (3rd ed.), Narosa, New Delhi.
3. Lipschutz, S. (1987): *Linear Algebra*, Schaum's Series, McGraw-Hill, New York
4. Butkov, E. (1968): *Mathematical Physics* , Addison-Wesley, Massachusetts.

5. Halmos, P.R. (1965): *Finite Dimensional Vector Spaces*, (2nd ed.), Affiliated East West, New Delhi.
6. Wylie, C.R. and Barrett, L.C. (1995): *Advanced Engineering Mathematics*, (6th ed.), International Edition, McGraw-Hill, New York.

Web Resources

1. www.khanacademy.org
2. https://youtu.be/LZnRlOA1_2I
3. http://hyperphysics.phy-astr.gsu.edu/hbase/hmat.html#hmath
4. https://www.youtube.com/watch?v=_2jymuM7OUU&list=PLhkiT_RYTEU27vS_SlED56gNjVJGO2qaZ
5. https://archive.nptel.ac.in/courses/115/106/115106086/

Course Designers

1. Dr. R.V. Krishnakumar
2. Dr. V. Rajniswamy

Thiagarajar College (Autonomous) Madurai – 625 009

Department of Physics

(For those joined M.Sc. Physics on or after June 2023)

PROGRAMME CODE: PPH

CourseCode	Course Title	Category	L	T	P	Credit
PPH23CT12	**CLASSICAL MECHANICS AND RELATIVITY**	**Core-2**	4	1	–	**4**

Year	Semester	Int. Marks	Ext. Marks	Total
First	First	25	75	100

Preamble

- Acquire acquaintance with basic concepts of classical mechanics and gain knowledge on principle of virtual work.
- Procure familiarity with Hamilton principles and its applications.
- Appreciate the theory of small oscillations and canonical transformations.
- Grasp knowledge to learn the theory of relativity.

Prerequisite

- Basic knowledge on Lagrangian, Hamiltonian equations and relativity

Course Outcome

On the completion of the course the student will be able to

		K Level	Expected Proficiency	Expectd Attainment
CO1	Understand the fundamentals of classical mechanics and its extension to Lagrangian formulation.	K1	75	70
CO2	Apply the concept of variational principle and Hamiltonian mechanics to solve the equations of motion of physical systems.	K3	75	70
CO3	Formulate the problem of small oscillations in systems and determine their normal modes of oscillations.	K4	75	70
CO4	Apply the concept of Canonical transformation and to acquire knowledgeon Lagrange and Poisson	K2,	75	70

	brackets.	K3		
CO5	Evaluate the principles of relativistic kinematics and apply it to the mechanical systems.	K5	75	70
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate				

Mapping of Course Outcome with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	L	M	L	M
CO2	S	M	S	L	S	L	M
CO3	S	L	M	L	S	M	S
CO4	M	M	L	L	S	M	L
CO5	S	L	S	S	S	L	L

Mapping of Course Outcome with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	L	S	L	M
CO2	L	M	L	L	S
CO3	L	L	S	–	M
CO4	M	S	S	L	M
CO5	L	M	L	S	M

Blooms Taxonomy: Assessment Patern

Bloom's category	CA		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge-K1	15% (9)	15% (9)	15% (20)
Understand-K2	15% (9)	15% (9)	15% (20)
Apply-K3	30% (18)	30% (18)	30% (40)
Analyze – K4	20% (12)	20% (12)	20% (25)
Evaluate – K5	20% (12)	20% (12)	20% (25)

	60	**60**	**130**

CLASSICAL MECHANICS AND RELATIVITY

UNIT I : CLASSICAL MECHANICS AND LAGRANGIAN FORMULATION

Mechanics of a particle-mechanics of a system of particles–conservation laws -constraints–generalized coordinates- configuration space–transformation equations-principle of virtual work-D'Alembert`s principle-Lagrange's equation of motion for conservative systems–applications: (i) simple pendulum (ii) Atwood`s machine (iii) projectile motion.

UNIT II : HAMILTONIAN FORMULATION

Hamilton's (variational) principle–some techniques of the calculus of variations–shortest distance between two points in a plane and Brachistochrone problem-Derivation of Lagrange's equations from Hamilton's principle.

Phase space – cyclic coordinates – conjugate momentum – Hamiltonian function – Hamilton's canonical equations of motion – applications: (i) simple pendulum (ii) one dimensional simple harmonic oscillator (iii) motion of particle in a central force field – The Principle of least action.

UNIT III : SMALL OSCILLATIONS

Formulation of the problem – the Eigen value equation and principle axis transformation – frequencies of free vibration and normal coordinates - Free vibrations of linear triatomic molecule.

UNIT IV : CANONICAL TRANSFORMATIONS

The equations of canonical transformation – Examples of canonical transformations – The symplectic approach to canonical transformations – Lagrange and Poisson brackets as canonical invariants – The equations of motion in Poisson bracket notation – Infinitesimal/constant transformations.

UNIT V : THEORY OF RELATIVITY

Inertial and non-inertial frames – Lorentz transformation equations – length contraction and time dilation – relativistic addition of velocities – Einstein's mass-energy relation – Minkowski's space – four vectors – position, velocity, momentum, acceleration and force in for vector notation and their transformations.

UNIT VI : PROFESSIONAL COMPONENTS Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism.

Text Books

1. Goldstein, H. Poole, C., Safko, J. (2002).*Classical Mechanics*, 3rd Edition, Pearson Edu.
2. Upadhyaya, J.C. (2019). *Classical Mechanics*, Himalaya Publshing. Co. New Delhi.
3. Resnick, R. (2021).*Introduction to Special Theory of Relativity*, Wiley.
4. TakwalaR.G. and Puranik, P.S. (1980). *Introduction to Classical Mechanics* –Tata – McGraw Hill, New Delhi,
5. RanaN.C. and Joag, P.S. (2001). Classical Mechanics,McGraw Hill Education (India) Private Limited 1 edition, ISBN 9780074603154.

Reference Books

1. Symon, K.R. (1971), *Mechanics*, Addison Wesley, London.
2. Biswas, S.N. (1999).*Classical Mechanics*, Books & Allied, Kolkata.
3. Gupta, Kumar and Sharma, (2021). *Classical Mechanics*, 31st Ed.,PragatiPrakashan, Meerut.
4. Kibble, T.W.B. *Classical Mechanics*, (c1970)ELBS/McGraw-Hill, New York..
5. Greenwood, D.T. *Classical Dynamics*, (1997). Rev. 2018, DoverPublications Inc.
6. SankaraRao, K.*Classical Mechanics*, (2005). Prentice-Hall of India, ISBN 81-203-2676-
7. Bhatia,V.B. (1997). *Classical Mechanics – With Introduction to Nonlinear Oscillations and Chaos*,.Narosa Publishing House, ISBN 81-7319-104-2.
8. Greiner, W. (2004). *Classical Mechanics – Systems of Particles and Hamiltonian Dynamics*, Springer, ISBN 81-8128-128-4.

Web Resources

1. http://poincare.matf.bg.ac.rs/~zarkom/Book_Mechanics_Goldstein_Classical_Mechanics_optimized.pdf
2. https://pdfcoffee.com/classical-mechanics-j-c-upadhyay-2014-editionpdf-pdf-free.html
3. https://nptel.ac.in/courses/122/106/122106027/
4. https://ocw.mit.edu/courses/physics/8-09-classical-mechanics-iii-fall-2014/lecture-notes/
5. https://www.britannica.com/science/relativistic-mechanics

Course Designers

1. Dr. N. Srinivasan
2. Dr. S. Rajakarthihan
3. Prof. R. Sribala

Thiagarajar College (Autonomous) Madurai – 625 009
Department of Physics
(For those joined M.Sc. Physics on or after June 2023)
PROGRAMME CODE: PPH

CourseCode	Course Title	Category	L	T	P	Credit
PPH23ET11	**LINEAR AND DIGITAL ICs AND APPLICATIONS**	**Core-3**	**3**	2	–	**3**

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	25	75	100

Preamble

- Realize the characteristics and applications of Op-Amp
- Provide an insight about fundamental concepts, techniques of Filters & 555 timer
- Study the Application of integrated circuits for analog-to-digital and digital-to-analog conversion
- Furnish exposure on CMOS logic, combinational circuits and sequential circuits

Prerequisite

- Knowledge of semiconductor devices, basic concepts of digital and analog electronics.

Course Outcome

On the completion of the course the student will be able to

#	Course Outcome	Knowledge Level	Expected Proficiency	Expectd Attainment
CO1	Learn about the basic concepts for the circuit configuration to design of linear integrated circuits and develops skill to solve problems	K1, K5	75	70
CO2	Develop skills to design linear and non-linear applications circuits using Op-Amp and design the active filters circuits.	**K3**	**75**	**70**
CO3	Gain knowledge about PLL, and develop skills to design the simple circuits using IC 555 and can solve problems related to it.	**K1 K3**	**75**	**70**
CO4	Learn about various techniques to develop A/D	**K2**	**75**	**70**

	and D/A converters.			
CO5	Acquire the knowledge about the CMOS logic, combinational and sequential circuits	**K1 K4**	**75**	**70**
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate				

Mapping of Course Outcome with Programme Outcomes

#	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	S	M	M
CO2	S	S	S	S	L	S
CO3	M	M	S	S	L	S
CO4	M	S	M	S	L	S
CO5	S	M	S	M	L	L

Mapping of Course Outcome with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	L	S
CO2	M	L	S	M	S
CO3	S	M	S	S	L
CO4	L	S	S	S	M
CO5	M	L	M	S	M

Blooms Taxonomy: Assessment Patern

Bloom's category	CA		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge-K1	15% (9)	15% (9)	15% (20)
Understand-K2	15% (9)	15% (9)	15% (20)
Apply-K3	30% (18)	30% (18)	30% (40)
Analyze – K4	20% (12)	20% (12)	20% (25)
Evaluate – K5	20% (12)	20% (12)	20% (25)
	60	**60**	**130**

LINEAR AND DIGITAL ICs AND APPLICATIONS

Unit I: INTEGRATED CIRCUITS AND OPERATIONAL AMPLIFIER

Introduction, Classification of IC's, basic information of Op-Amp 741 and its features, the ideal Operational amplifier, Op-Amp internal circuit and Op-Amp. Characteristics.

Unit II: APPLICATIONS OF OP-AMP

LINEAR APPLICATIONS OF OP-AMP: Solution to simultaneous equations and differential equations, Instrumentation amplifiers, V to I and I to V converters.

NON-LINEAR APPLICATIONS OF OP-AMP:

Sample and Hold circuit, Log and Antilog amplifier, multiplier and divider, Comparators, Schmitt trigger, Multivibrators, Triangular and Square waveform generators.

Unit III: ACTIVE FILTERS & TIMER AND PHASE LOCKED LOOPS

ACTIVE FILTERS: Introduction, Butterworth filters – 1st order, 2nd order low pass and high pass filters, band pass, band reject and all pass filters.

TIMER AND PHASE LOCKED LOOPS: Introduction to IC 555 timer, description of functional diagram, monostable and astable operations and applications, Schmitt trigger, PLL - introduction, basic principle, phase detector/comparator, voltage controlled oscillator (IC 566), low pass filter, monolithic PLL and applications of PLL.

Unit IV: VOLTAGE REGULATOR & D to A AND A to D CONVERTERS

VOLTAGE REGULATOR: Introduction, Series Op-Amp regulator, IC Voltage Regulators, IC 723 general purpose regulators, Switching Regulator.

D to A AND A to D CONVERTERS: Introduction, basic DAC techniques -weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A to D converters -parallel comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC Specifications.

Unit V: CMOS LOGIC, COMBINATIONAL CIRCUITS USING TTL 74XX ICs &SEQUENTIAL CIRCUITS USING TTL 74XX ICs

CMOS LOGIC: CMOS logic levels, MOS transistors, Basic CMOS Inverter, NAND and NOR gates, CMOS AND-OR-INVERT and OR-AND-INVERT gates, implementation of any function using CMOS logic.

COMBINATIONAL CIRCUITS USING TTL 74XX ICs: Study of logic gates using 74XX ICs, Four-bit parallel adder (IC 7483), Comparator (IC 7485), Decoder (IC 74138, IC 74154), BCD to 7-segment decoder (IC7447), Encoder (IC74147), Multiplexer (IC74151), Demultiplexer (IC 74154).

SEQUENTIAL CIRCUITS USING TTL 74XX ICs: Flip Flops (IC 7474, IC 7473), Shift Registers, Universal Shift Register (IC 74194), 4- bit asynchronous binary counter (IC 7493).

Text Books

1. D. Roy Choudhury, Shail B. Jain (2012), *Linear Integrated Circuit*, 4th edition, New Age International Pvt. Ltd., New Delhi, India
2. Ramakant A. Gayakwad, (2012), *OP-AMP and Linear Integrated Circuits*, 4th edition, Prentice Hall / Pearson Education, New Delhi.
3. TherajaB.L. and Theraja, A.K. (2004).*A Textbook of Electrical technology*, S. Chand & Co. New Delhi.
4. Mehta V.K. and Rohit Mehta, (2008).*Principles of Electronics*, 12th Edition S. Chand &Co,.New Delhi
5. Vijayendran, V. (2008).*Introduction to Integrated electronics* (Digital & Analog), S. Viswanathan Printers & Publishers Private Ltd, Reprint. V.

Reference Books

1. Sergio Franco (1997), *Design with operational amplifiers and analog integrated circuits*, McGraw Hill, New Delhi.
2. Gray, Meyer (1995), *Analysis and Design of Analog Integrated Circuits*, Wiley International, New Delhi.
3. Malvino and Leach (2005), *Digital Principles and Applications*5th Edition, Tata McGraw Hill, New Delhi.
4. Floyd, Jain (2009), *Digital Fundamentals*, 8th edition, Pearson Education, New Delhi.
5. Millman&Halkias, (2000).*Integrated Electronics*, Tata McGraw Hill, 17th Reprint

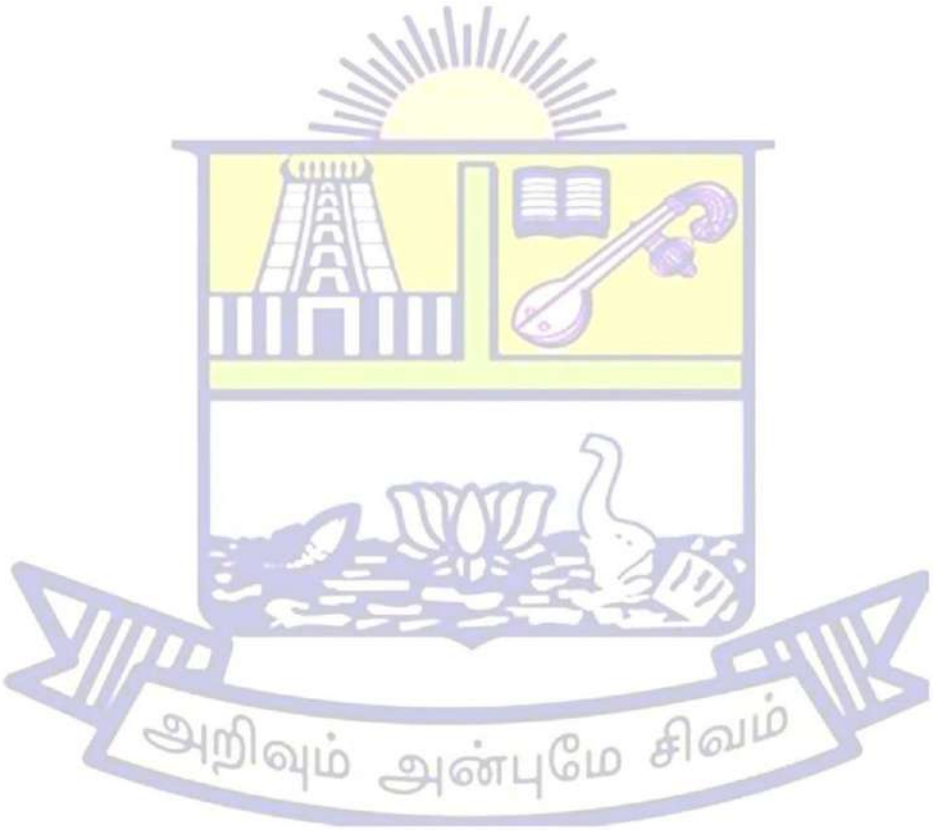
Web Resources

1. https://nptel.ac.in/course.html/digital circuits/
2. https://nptel.ac.in/course.html/electronics/operational amplifier/

3. https://www.allaboutcircuits.com/textbook/semiconductors/chpt-7/field-effect-controlled-thyristors/
4. https://www.electrical4u.com/applications-of-op-amp/
5. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/

Course Designers

1. Dr.R.Srinivasan
2. Dr.R.Dhanalakshmi
3. S.Alaguraja



Thiagarajar College (Autonomous):: Madurai – 625 009

Department of Physics

(For those joined M.Sc. Physics on or after June 2023)

PROGRAMME CODE: PPH

CourseCode	Course Title	Category	L	T	P	Credit
PPH23ET12	**Communication Electronics**	**Elective - 1**	**3**	2	–	**3**

Year	Semester	Int. Marks	Ext. Marks	Total
First	First	25	75	100

Preamble

- Appreciate the transmission of electromagnetic waves thorough different types of antenna and also to acquire knowledge about the propagation of waves through earth's atmosphere and along the surface of the earth
- Gain knowledge in the generation and propagation of microwaves
- Acquire knowledge about radar systems and its applications and also the working principle of colour television
- Learn the working principle of fiber optics and its use in telecommunication
- Understand the general theory and operation of satellite communication systems

Prerequisite

Knowledge of Regions of electromagnetic spectrum and its characteristics

Course Outcome

On the completion of the course the student will be able to

#	Course Outcome	Knowledge Level	Expected Proficiency	Expectd Attai nment
CO1	Discuss and compare the propagation of electromagnetic waves through sky and on earth's surface Evaluate the energy and power radiated by the different types of antenna	K 1	7 5	7 0
CO2	Compare and differentiate the methods of generation of microwaves analyze the propagation of microwaves through wave guides- discuss and compare the different methods of generation of microwaves	K2	75	70
CO3	Classify and compare the working of different radar systems- apply the principle of radar in detecting locating, tracking, and recognizing objects of various kinds at considerable distances – discuss the importance of radar in	K3	75	70

	military- elaborate and compare the working of different picture tube			
CO4	Classify, discuss and compare the different types of optical fiber and also to justify the need of it-discover the use of optical fiber as wave guide	K4	75	70
CO5	Explain the importance of satellite communication in our daily life-distinguish between orbital and geostationary satellites elaborate the linking of satellites with ground station on the earth	K4, K5	75	70

Mapping of Course Outcome with Programme Outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	S	M	S	L	M	M	S
CO2	S	M	S	L	M	M	S
CO3	S	M	S	L	M	M	S
CO4	S	M	S	L	M	M	S
CO5	S	M	S	L	M	M	S

Mapping of Course Outcome with Programme Specific Outcomes

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	L	M	S	S
CO2	S	L	M	M	M
CO3	S	L	M	M	M
CO4	S	L	M	M	M
CO5	S	L	M	M	M

Blooms Taxonomy: Assessment Patern

Bloom's category	**CA**		**End of Semester Marks**
	I Internal Marks	**II Internal Marks**	
Knowledge-K1	15% (9)	15% (9)	15% (20)
Understand-K2	15% (9)	15% (9)	15% (20)
Apply-K3	30% (18)	30% (18)	30% (40)
Analyze – K4	20% (12)	20% (12)	20% (25)
Evaluate – K5	20% (12)	20% (12)	20% (25)
	60	**60**	**130**

COMMUNICATION ELECTRONICS

UNIT I: ANTENNAS AND WAVE PROPAGATION

Radiation field and radiation resistance of short dipole antenna-grounded antenna-ungrounded antenna-antenna arrays-broadside and end side arrays-antenna gain-directional high frequency antennas-sky wave-ionosphere- Ecles and Larmor theory-Magnento ionic theory-ground wave propagation

UNIT II: MICROWAVES

Microwave generation—multi cavity Klystron-reflex klystron-magnetron travelling wave tubes (TWT) and other microwave tubes-MASER-Gunn diode-wave guides-rectangular wave guides-standing wave indicator and standing wave ratio(SWR)

UNIT III: RADAR ANDTELEVISION

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 -cable TV, CCTV and theatre TV.

UNIT IV: OPTICAL FIBER

Propagation of light in an optical fibre-acceptance angle-numerical aperture-step and graded index fibres-optical fibres as a cylindrical wave guide-wave guide equations-wave guide equations in step index fibres - fibre losses and dispersion-applications

UNIT V: SATELLITECOMMUNICATION

Orbital satellites-geostationary satellites-orbital patterns-satellite system link models-satellite system parameters-satellite system link equation link budget-INSAT communication satellites

UNIT VI:PROFESSIONAL COMPONENTS

Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism

Text Books

1. Gupta, Kumar, (2008). *Handbook of Electronics*, PragatiPrakashan, Meerut.

2. George Kennedy, Davis, (1988). *Electronic communication systems*, Tata McGraw Hill, 4th Edition, New Delhi.
3. Taub and Schilling, (1991). *Principles of communication systems*, 2nd Edition, Tata McGraw Hill, New Delhi.
4. Kulkarani, M. (1998). *Microwave and radar engineering*, Umesh Publications, New Delhi.
5. Ghulathi,R. R. (2005). *Mono Chrome and colour television*, New Age International (P) Limited, New Delhi.

Reference Books

1. Dennis Roody, Coolen, (1995). *Electronic communications*, 4th Edition, Prentice Hall of India, New Delhi.
2. Wayne Tomasi, (1998). *Advanced electronics communication systems*, 4th Edition, Prentice Hall of India, New Delhi.
3. S. Salivahanan, N. Suersh Kumar, A. Vallavaraj, (2009). *Electronic Devices and Circuits*, 4nd Edition, Tata McGraw-Hill Publishing Company Limited, New Delhi.

Web Resources

1. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/
2. https://www.polytechnichub.com/difference-analog-instruments-digital-instruments/
3. http://nptel.iitm.ac.in/
4. http://web.ewu.edu/
5. http://nptel.iitm.ac.in/

Course Designers

1. Dr. G.Arivazhagan
2. Mr. M.Venkatachalam
3. Dr.D.Yamini

Thiagarajar College (Autonomous) :: Madurai – 625 009

Department of Physics

(For those joined M.Sc. Physics on or after June 2023)

PROGRAMME CODE: PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH23AT11	Ethics in Research and Publishing	AECC - 1	2	-	-	2

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	25	75	100

Preamble

- Acquire knowledge about research and ethics in publishing.
- Able to understand ethical practices in measurements
- Know to communicate science as an outreach.

Prerequisite

- Gain exposure in research and publishing ethics.

Course Outcome

#	Course Outcome	Knowledge Level	Expected Proficiency	Expectd Attainment
CO1	Know about ethics in research	K1	80	75
CO2	Understand the options present in the visual display of data.	K2	80	75
CO3	Comprehend the responsibilities of authors in publishing	K2,K3	80	75
CO4	Develop ethical practices by communicating science to the public	K4	80	75
CO5	Realize the case studies in ethics	K5	80	75

Mapping of Course Outcome with Programme Outcomes

#	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	M	S	S	S	L	S	L
CO2	S	S	S	M	L	S	L
CO3	S	S	S	M	L	S	S
CO4	S	S	S	M	L	S	S
CO5	L	S	S	M	L	S	S

Mapping of Course Outcome with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	M	L	M	S
CO2	M	S	M	L	M
CO3	S	M	L	M	M
CO4	S	M	L	M	M
CO5	M	M	L	S	M

Blooms Taxonomy: Assessment Patern

Bloom's category	CA		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge-K1	15% (9)	15% (9)	15% (20)
Understand-K2	15% (9)	15% (9)	15% (20)
Apply-K3	30% (18)	30% (18)	30% (40)
Analyze – K4	20% (12)	20% (12)	20% (25)
Evaluate – K5	20% (12)	20% (12)	20% (25)
	60	**60**	**130**

ETHICS IN RESEARCH AND PUBLISHING

Unit I: Ethics of Research

Introduction- Topic of research- collaborative research and sharing of credits- research supervisor and student relationship.

Unit II: Ethics in Measurement Practices

Laboratory record- options in the visual display of data- fidelity of analysis-precision, accuracy and errors-significant figures- Biases around probability.

Unit III: Ethics of publication

Introduction- authors and contributors-General responsibility of authors- ethical conventions of publications

Unit IV: Ethical Practices in science outreach

Outreach as an obligation- Ethics in communicating science- Responsibilities of journalists and public.

Unit V: Case studies in ethics

Conflict of interest case study confidentiality scenario-Data Acquisition Case Study: Intellectual Property-Educational Concerns Case Study: Reporting Violations and Plagiarism-Health & Safety Case Study: Hazardous Materials.

Text Books

1. K Muralidhar ,AmitGhosh, AK Singhvi(2019). Ethics in Science Education,Research and Governance edited by Indian National Science Academy New Delhi, India

Reference Books

1. Case studies developed by the APS Task Force on Ethics Education.

Web Resources

1. https://youtu.be/32BLIRIgZGo
2. https://youtu.be/LmMDIBENHhU

Course Designers

1. Dr. R.V.Krishnakumar
2. Dr.D.Yamini

Thiagarajar College (Autonomous) :: Madurai – 625 009

Department of Physics

(For those joined B.Sc. Physics on or after June 2023)

PROGRAMME CODE: PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH23ST11	COMPUTATIONAL PHYSICS	SEC – 1	2	1	-	2

Year	Semester	Int. Marks	Ext.Marks	Total
I	I	25	75	100

Preamble

- Expose the students to use free and open-source software.
- Know the basic concepts of scientific programming
- Extend their manipulative skills to develop new algorithms
- Help students apply SCILAB in solving problems of Physics

Prerequisite

Fundamental knowledge of mathematics and physics

Course Outcome

On the completion of the course the student will be able to

#	Course Outcome	Knowledge Level	Expected Proficiency	Expectd Attai nment
CO1	Understand the basics of Scilab environment	K1, K2	80	75
CO2	Able to understand data structures of scilab in mathematical functions and able to apply them to solve simple problems.	K2, K3	80	75
CO3	Analyze data structures of scilab in matrices and basic matrix processing	K3	80	75
CO4	Recognize the concepts of looping, branching functions in SCILAB and write a simple program in Scilab	K4, K5	80	75
CO5	Understand the graphic output identify the versatility of SCILAB in physics	K2, K5	80	75

Mapping of Course Outcome with Programme Outcomes

#	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	L	L	M	L	M	-	L
CO2	L	M	M	L	M	-	L
CO3	M	M	S	M	M	L	M
CO4	M	M	S	M	S	L	M
CO5	M	M	S	M	M	L	M

Mapping of Course Outcome with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	L	M	M	M	L
CO2	M	M	M	M	M
CO3	M	M	M	M	M
CO4	S	S	S	S	M
CO5	M	M	M	S	M

Blooms Taxonomy: Assessment Pattern

Bloom's taxonomy			
Category	**Continuous Assignment**		**End of Semester Marks**
	I Internal Marks	**II Internal Marks**	
Knowledge-K1	15% (5)	15% (5)	15% (10)
Understand-K2	15% (4)	15% (4)	15% (8)
Apply-K3	30% (9)	30% (9)	30% (18)
Analyze-K4	20% (6)	20% (6)	20% (12)
Evaluate-K5	20% (6)	20% (6)	20% (12)
Total Marks	**30**	**30**	**60**

COMPUTATIONAL PHYSICS

Unit I: INTRODUCTION TO SCILAB

Introduction- TheScilab environment-Manipulating the command line- Comments-The Scilab menu bar-exercises

Unit II: SCALARS AND VECTORS

Initialising vectors in Scilab- mathematical, relational, and logical operations on Vectors-built-in-logical functions-elementary mathematical functions-mathematical functions on scalars- complex numbers-trigonometric, inverse trigonometric and hyperbolic functions-exercises

Unit III: MATRICES

Introduction-Arithmetic operators for matrices-basic matrix processing-exercises

Unit IV: PROGRAMMING IN SCILAB

Introduction-variables- statements-operators- input and output-Control/branching/conditional statements-break and continue-exercises

Unit V: GRAPHIC OUTPUT

Introduction-2D plotting-3d plotting- other graphic primitives and commands-exercises.

Text Books

1. HemaRamachandran&AchutsankarS.Nair, (2012).*SCILAB*, First edition, S.Chand& company Ltd., New Delhi.

Reference Books

1. Sandeep Nagar, (2017). *Introduction to Scilab: For Engineers and Scientists*Apress, New York, USA. ISBN-13 (pbk): 978-1-4842-3191-3 ISBN-13 (electronic): 978-1-4842-3192-0 https://doi.org/10.1007/978-1-4842-3192-0
2. Amos Gilat, (2009). *MATLAB: An Introduction with Applications*, John Wiley & Sons, Inc., U.K.
3. Kirani Singh Y &Chaudhuri B.B., (2008). *MATLAB Programming*, Prentice Hall of India Pvt. Ltd., New Delhi.
4. Raj Kumar Bansal, Ashok Kumar Goel& Manoj Kumar Sharma, (2009). *MATLAB and its Applications in Engineering*, Dorling kinderselyPvt. Ltd., New Delhi:
5. Stephan J. Chapman, (2008). *MATLAB Programming for Engineers*,Cengage Learning India Pvt. Ltd., New Delhi:

Thiagarajar College (Autonomous) :: Madurai – 625 009

Department of Physics

(For those joined M.Sc. Physics on or after June 2023)

PROGRAMME CODE: PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH23CT21	**STATISTICAL MECHANICS**	Core – 3	4	1	-	4

Year	Semester	Int. Marks	Ext.Marks	Total
First	Second	25	75	100

Preamble

- To acquire the knowledge of thermodynamic potentials and to understand phase transition in thermodynamics
- To identify the relationship between statistical and thermodynamic quantities
- To comprehend the concept of partition function, canonical and grand canonical ensembles
- To grasp the fundamental knowledge about the three types of statistics
- To get in depth knowledge about phase transitions and fluctuation of thermodynamic properties that vary with time

Prerequisite

Laws of thermodynamics, phase transition, entropy, ensembles, partition function, classical and quantum statistics, thermal equilibrium, Brownian motion

Course Outcome

At the end of the course the student will be able to

#	Course Outcome	Knowledge Level	Expected Proficiency	Expectd Attainment
CO1	Examine and explore the effect of changes in thermodynamic quantities on the states of matter during phase transition	**K5**	**75**	**70**
CO2	Analyze the macroscopic properties such as pressure, volume, temperature, specific heat, elastic moduli etc. in terms of microscopic properties like intermolecular forces, chemical bonding, atomicity etc., Describe the peculiar behaviour of the entropy by mixing two gases and understand the connection between statistics and thermodynamic quantities.	**K4**	**75**	**70**

CO3	Differentiate between canonical and grand canonical ensembles. To realize the relation between thermodynamical quantities and partition function.	**K1**	**75**	**70**
CO4	Recall and apply the concepts of statistical mechanics so as to explore the behaviour of ideal Fermi gas and ideal Bose gas.	**K4, K5**	**75**	**70**
CO5	Discuss and examine the thermodynamical behaviour of gases using Ising model.	**K3**	**75**	**70**
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate				

Mapping of Course Outcome with Programme Outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**
CO1	S	S	M	L	L	M	M
CO2	S	M	L	L	M	S	S
CO3	M	S	S	M	L	M	M
CO4	M	S	L	S	S	M	S
CO5	S	S	M	L	S	S	M

S=Strong, M=Medium and L=Low

Mapping of Course Outcome with Programme Specific Outcomes

	PSO1	**PSO2**	**PSO3**	**PSO4**	**PSO5**
CO1	S	M	M	S	S
CO2	S	M	M	S	M
CO3	S	S	M	L	S
CO4	M	L	M	M	S
CO5	S	L	S	M	S

Blooms Taxonomy: Assessment Pattern

Bloom's category	**CA**		**End of Semester Marks**
	I Internal Marks	**II Internal Marks**	
Knowledge-K1	15% (9)	15% (9)	15% (20)
Understand-K2	15% (9)	15% (9)	15% (20)
Apply-K3	30% (18)	30% (18)	30% (40)
Analyze – K4	20% (12)	20% (12)	20% (25)
Evaluate – K5	20% (12)	20% (12)	20% (25)
	60	**60**	**130**

STATISTICAL MECHANICS

UNIT I PHASE TRANSITIONS

Thermodynamic potentials - Phase Equilibrium - Gibb's phase rule - Phase transitions and Ehrenfest's classifications –Third law of Thermodynamics.Order parameters – Landau's theory of phase transition - Scale transformations and dimensional analysis.

UNIT II STATISTICAL MECHANICS AND THERMODYNAMICS

Foundations of statistical mechanics - Specification of states of a system - Micro canonical ensemble - Phase space – Entropy - Connection between statistics and thermodynamics – Entropy of an ideal gas using the micro canonical ensemble - Entropy of mixing and Gibb's paradox.

UNIT III CANONICAL AND GRAND CANONICAL ENSEMBLES

Trajectories and density of states - Liouville's theorem - Canonical and grand canonical ensembles - Partition function - Calculation of statistical quantities - Energy and density fluctuations.

UNIT IV CLASSICAL AND QUANTUM STATISTICS

Density matrix - Statistics of ensembles - Statistics of indistinguishable particles - Maxwell-Boltzmann statistics - Fermi-Dirac statistics – Ideal Fermi gas – Degeneracy - Bose-Einstein statistics - Plank radiation formula - Ideal Bose gas - Bose-Einstein condensation.

UNIT V REAL GAS, ISING MODEL AND FLUCTUATIONS

Ising model - Mean-field theories of the Ising model in three, two and one dimensions - Exact solutions in one dimension.Correlation of space-time dependent fluctuations - Fluctuations and transport phenomena - Brownian motion - Langevin's theory.

UNIT VI PROFESSIONAL COMPONENTS

Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism.

Text Books

1. Agarwal, B.K., Eisner, M. (1998). *Statistical Mechanics*, Second Ed., New Age International, New Delhi.
2. Sinha, S.K. *Statistical Mechanics*, (1990). Tata McGraw Hill, New Delhi.
3. Bhattacharjee, J.K. (1996). *Statistical Mechanics: An Introductory Text*, Allied Publication, New Delhi.
4. Reif, F. (1965). *Fundamentals of Statistical and Thermal Physics*, McGraw -Hill, New York.
5. Zemansky,M.K. (1968). *Heat and Thermodynamics*, Fifth ed., McGraw-Hill New York.

Reference Books

1. Pathria, R.K. (1996). *Statistical Mechanics*, Second ed., ButterWorthHeinemann, New Delhi.
2. Landau, L.D., Lifshitz, E.M., (1969), *Statistical Physics*, Pergamon Press, Oxford,.
3. K. Huang, K. (2002). *Statistical Mechanics*, Taylor and Francis, London.
4. Greiner, W. Neise, L., Stoecker, H. (1995). *Thermodynamics and Statistical Mechanics*, Springer Verlang, New York.
5. Gupta, A.B. Roy, H. (2002). Thermal Physics, Books and Allied, Kolkata..

Web Resources

1. https://byjus.com/chemistry/third-law-of-thermodynamics/
2. https://web.stanford.edu/~peastman/statmech/thermodynamics.html
3. https://en.wikiversity.org/wiki/Statistical_mechanics_and_thermodynamics
4. https://en.wikipedia.org/wiki/Grand_canonical_ensemble
5. https://en.wikipedia.org/wiki/Ising_model

Course Designers

1. Dr. G. Arivazhagan
2. Prof. M.Venkatachalam

Thiagarajar College (Autonomous) :: Madurai – 625 009

Department of Physics

(For those joined M.Sc. Physics on or after June 2023)

PROGRAMME CODE: PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH23CT22	**QUANTUM MECHANICS – I**	Core – 4	4	1	-	4

Year	Semester	Int. Marks	Ext.Marks	Total
First	Second	25	75	100

Preamble

- To develop the physical principles and the mathematical background important to quantum mechanical descriptions.
- To describe the propagation of a particle in a simple, one-dimensional potential.
- To formulate and solve the Schrodinger's equation to obtain eigenvectors and energies for particle in a three-dimensional potential.
- To explain the mathematical formalism and the significance of constants of motion, and see their relation to fundamental symmetries in nature.
- To discuss the Approximation methods like perturbation theory, Variational and WKB methods for solving the Schrödinger equation.

Prerequisite

Newton's laws of motion, Schrodinger's equation, integration, differentiation.

Course Outcome

On the completion of the course the student will be able to

#	Course Outcome	Knowledge Level	Expected Proficiency	Expectd Attainment
CO1	Demonstrates a clear understanding of the basic postulates of quantum mechanics which serve to formalize the rules of quantum mechanics.	**K1, K5**	**75**	**70**
CO2	Able to apply and analyze the Schrodinger equation to solve one dimensional problems and three dimensional problems	**K3, K4**	**75**	**70**
CO3	Can discuss the various representations, space time symmetries and formulations of time evolution	**K1, K2**	**75**	**70**
CO4	Can formulate and analyze the approximation methods for various quantum mechanical problems.	**K4, K5**	**75**	**70**

CO5	To apply non-commutative algebra for topics such as angular and spin angular momentum and hence explain spectral line splitting.	**K3,K4**	**75**	**70**
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate				

Mapping of Course Outcome with Programme Outcomes

#	PO1	PO2	PO3	PO4	PO5	PO6
CO1	**S**	**S**	**S**	**M**	**M**	**S**
CO2	**S**	**M**	**S**	**S**	**M**	**S**
CO3	**S**	**M**	**M**	**S**	**L**	**S**
CO4	**S**	**S**	**M**	**S**	**L**	**S**
CO5	**M**	**M**	**S**	**M**	**L**	**L**

Mapping of Course Outcome with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**M**	**S**	**L**	**S**
CO2	**S**	**L**	**M**	**M**	**S**
CO3	**S**	**M**	**M**	**S**	**M**
CO4	**M**	**S**	**S**	**S**	**M**
CO5	**M**	**L**	**M**	**S**	**M**

Blooms Taxonomy: Assessment Pattern

Bloom's category	CA		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge-K1	15% (9)	15% (9)	15% (20)
Understand-K2	15% (9)	15% (9)	15% (20)
Apply-K3	30% (18)	30% (18)	30% (40)
Analyze – K4	20% (12)	20% (12)	20% (25)
Evaluate – K5	20% (12)	20% (12)	20% (25)
	60	**60**	**130**

QUANTUM MECHANICS – I

UNIT I : BASIC FORMALISM

Interpretation of the wave function – Time dependent Schrodinger equation –Time independent Schrodinger equation – Stationary states – Ehrenfest's theorem – Linear vector space – Linear operator – Eigen functions and Eigen Values – Hermitian Operator – Postulates of Quantum Mechanics – Simultaneous measurability of observables – General Uncertainty relation

UNIT II : ONE-DIMENSIONAL AND THREE-DIMENSIONAL ENERGY EIGEN VALUE PROBLEMS

Square – well potential with rigid walls – Square well potential with finite walls – Square potential barrier – Alpha emission – Bloch waves in a periodic potential – Kronig-penny square – well periodic potential – Linear harmonic oscillator: Operator method – Particle moving in a spherically symmetric potential – System of two interacting particles – Hydrogen atom – Rigid rotator

UNIT III : GENERAL FORMALISM

Dirac notation – Equations of motions – Schrodinger representation – Heisenberg representation – Interaction representation – Coordinate representation – Momentum representation – Symmetries and conservation laws – Unitary transformation – Parity and time reversal

UNIT IV : APPROXIMATION METHODS

Time independent perturbation theory for non-degenerate energy levels – Degenerate energy levels – Stark effect in Hydrogen atom – Ground and excited state – Variation method – Helium atom – WKB approximation – Connection formulae (no derivation) – WKB quantization – Application to simple harmonic oscillator.

UNIT V : ANGULAR MOMENTUM

Eigenvalue spectrum of general angular momentum – Ladder operators and their algebra – Matrix representation – Spin angular momentum – Addition of angular momenta – CG Coefficients – Symmetry and anti – symmetry of wave functions – Construction of wave-functions and Pauli's exclusion principle.

UNIT VI : PROFESSIONAL COMPONENTS

Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism.

Text Books

1. Mathews P.M. and Venkatesan, K. (2010). *A Text book of Quantum Mechanics*, 2nd edition(37th Reprint),Tata McGraw-Hill, New Delhi.
2. Aruldhas, G. (2009). *Quantum Mechanics*, 2nd edition, Prentice Hall of India, New Delhi.
3. David J Griffiths, (2011). *Introduction to Quantum Mechanics*. 4th edition, Pearson,
4. Gupta SL and Gupta, ID. (1982). *Advanced Quantum Theory and Fields*, 1st Edition, S.Chand& Co., New Delhi.
5. GhatakA. and Lokanathan, S. (1984). *Quantum Mechanics: Theory and Applications*, 4thEdition, Macmillan, India.

Reference Books

1. Merzbacher, E. *Quantum Mechanics*, (1970). 2nd Edition, John Wiley and Sons, New York.
2. Thankappan, V. K. (1985). *Quantum Mechanics*, 2nd Edition, Wiley Eastern Ltd, New Delhi.
3. Landau L.D. and Lifshitz, E.M. (1976). *Quantum Mechanics*, 1st edition, Pergomon Press, Oxford, 1976.
4. Biswas, S.N. (1999). *Quantum Mechanics*, Books and Allied Ltd., Kolkata, 1999.
5. Devanathan, V. (2011). *Quantum Mechanics*, 2nd edition, Alpha Science International Ltd, Oxford.
6. Satyaprakash& Swati Satya (2006). *Quantum Mechanics*, KedarNath Ram Nath& Co.

Web Resources

1. http://research.chem.psu.edu/lxjgroup/download_files/chem565-c7.pdf
2. http://www.feynmanlectures.caltech.edu/III_20.html
3. http://web.mit.edu/8.05/handouts/jaffe1.pdf
4. https://hepwww.pp.rl.ac.uk/users/haywood/Group_Theory_Lectures/Lecture_ 1.pdf
5. https://theory.physics.manchester.ac.uk/~xian/qm/chapter3.pdf

Course Designers

1. Dr. N. Srinivasan
2. Dr. V. Rajniswamy
3. Prof. R. Sribala

Thiagarajar College (Autonomous) :: Madurai – 625 009

Department of Physics

(For those joined M.Sc. Physics on or after June 2023)

PROGRAMME CODE: PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH23ET21	**CHARACTERIZATON OF MATERIALS**	Core – 7	3	2	-	3

Year	Semester	Int. Marks	Ext.Marks	Total
First	Second	25	75	100

Preamble

- Acquire some important thermal analysis techniques namely TGA, DTA, DSC and TMA.
- Realize the theory of image formation in an optical microscope and to introduce other specialized microscopic techniques.
- Attain and understand the principle of working of electron microscopes and scanning probe microscopes.
- Apprehend some important electrical and optical characterization techniques for semiconducting materials.
- Familiarize the basics of x-ray diffraction techniques and some important spectroscopic techniques.

Prerequisite

Fundamentals of Heat and Thermodynamics, Basics of Optical systems, Microscopic systems, Electrical measurements and Fundamentals of Spectroscopy.

Course Outcome

On the completion of the course the student will be able to

#	Course Outcome	Knowledge Level	Expected Proficiency	Expectd Attai nment
CO1	Describe the TGA, DTA, DSC and TMA thermal analysis techniques and make interpretation of the results.	**K1, K3**	**75**	**70**
CO2	The concept of image formation in Optical microscope, developments in other specialized microscopes and their applications.	**K2**	**75**	**70**

CO3	The working principle and operation of SEM, TEM, STM and AFM.	**K2, K3**	**75**	**70**
CO4	Understood Hall measurement, four –probe resistivity measurement, C-V, I-V, Electrochemical, Photoluminescence and electroluminescence experimental techniques with necessary theory.	**K3, K4**	**75**	**70**
CO5	The theory and experimental procedure for x-ray diffraction and some important spectroscopic techniques and their applications.	**K4,K5**	**75**	**70**

Mapping of Course Outcome with Programme Outcomes

#	PO1	PO2	PO3	PO4	PO5	PO6
CO1	**S**	**S**	**S**	**M**	**M**	**S**
CO2	**S**	**M**	**S**	**S**	**M**	**S**
CO3	**S**	**M**	**M**	**S**	**L**	**S**
CO4	**S**	**S**	**M**	**S**	**L**	**S**
CO5	**M**	**M**	**S**	**M**	**L**	**L**

Mapping of Course Outcome with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	**S**	**M**	**S**	**L**	**S**
CO2	**S**	**L**	**M**	**M**	**S**
CO3	**S**	**M**	**M**	**S**	**M**
CO4	**M**	**S**	**S**	**S**	**M**
CO5	**M**	**L**	**M**	**S**	**M**

Blooms Taxonomy: Assessment Pattern

Bloom's category	CA		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge-K1	15% (9)	15% (9)	15% (20)
Understand-K2	15% (9)	15% (9)	15% (20)
Apply-K3	30% (18)	30% (18)	30% (40)
Analyze – K4	20% (12)	20% (12)	20% (25)
Evaluate – K5	20% (12)	20% (12)	20% (25)
	60	**60**	**130**

CHARACTERIZATION OF MATERIALS

Unit I: THERMAL ANALYSIS

Introduction – thermo gravimetric analysis (TGA) – instrumentation – determination of weight loss and decomposition products – differential thermal analysis (DTA)- cooling curves – differential scanning calorimetry (DSC) – instrumentation – specific heat capacity measurements – determination of thermo mechanical parameters.

Unit II: MICROSCOPIC METHODS

Optical Microscopy: optical microscopy techniques – Bright field optical microscopy – Dark field optical microscopy – Dispersion staining microscopy - phase contrast microscopy –differential interference contrast microscopy - fluorescence microscopy - confocal microscopy - - digital holographic microscopy - oil immersion objectives - quantitative metallography - image analyzer.

Unit III: ELECTRON MICROSCOPY AND SCANNING PROBE MICROSCOPY

SEM, EDAX, EPMA, TEM: working principle and Instrumentation – sample preparation –Data collection, processing and analysis- Scanning tunneling microscopy (STEM) - Atomic force microscopy (AFM) - Scanning new field optical microscopy.

Unit IV: ELECTRICAL METHODS AND OPTICAL CHARACTERISATION

Two probe and four probe methods- van der Pauw method – Hall probe and measurement – scattering mechanism – C-V characteristics – Schottky barrier capacitance – impurity concentration – electrochemical C-V profiling – limitations. Photoluminescence – light – matter interaction – instrumentation – electroluminescence – instrumentation – Applications.

Unit V: X-RAY AND SPECTROSCOPIC METHODS

Principles and instrumentation for UV-Vis-IR, FTIR spectroscopy, Raman spectroscopy, ESR, NMR, NQR, XPS, AES and SIMS-proton induced X-ray Emission spectroscopy (PIXE) –Rutherford Back Scattering (RBS) analysis-application - Powder diffraction - Powder diffractometer -interpretation of diffraction patterns - indexing - phase identification - residual stress analysis - Particle size, texture studies - X-ray fluorescence spectroscopy - uses.

Text Books

1. StradlingR.A. and Klipstain. P.C.(1990). *Growth and Characterization of semiconductors.* Adam Hilger, Bristol.
2. Belk. J.A. (1979). *Electron microscopy and microanalysis of crystalline materials.* Applied Science Publishers, London.
3. Lawrence E. Murr. (1991). Electron *and Ion microscopy and Microanalysis principles and Applications.* Marcel Dekker Inc., New York.
4. KealeyD. and Haines. P.J. (2002).*Analytical Chemistry*. Viva Books Private Limited, New Delhi, 2002.
5. Li, Lin, Ashok Kumar (2008). *Materials Characterization Techniques* Sam Zhang; CRC Press.

Reference Books

1. Cullity, B.D., and Stock, R.S., (2001). "*Elements of X-Ray Diffraction*", Prentice-Hall.
2. Murphy, Douglas B, (2001).*Fundamentals of Light Microscopy and Electronic Imaging*, Wiley-Liss, Inc. USA,
3. Tyagi, A.K., Roy, Mainak, Kulshreshtha, S.K., and Banerjee, S., (2009).*Advanced Techniques for Materials Characterization, Materials Science Foundations* (monograph series), Volumes 49 – 51, Volumes 49 – 51, (2009).
4. Wendlandt, W.W., (1986).*Thermal Analysis*, John Wiley & Sons.
5. Wachtman, J.B., Kalman, Z.H., (1993).*Characterization of Materials*, Butterworth Heinemann.

Web Resources

1. https://cac.annauniv.edu/uddetails/udpg_2015/77.%20Mat%20Sci(AC).pdf
2. http://www.digimat.in/nptel/courses/video/113106034/L11.html
3. https://nptel.ac.in/courses/104106122
4. https://nptel.ac.in/courses/118104008
5. https://www.sciencedirect.com/journal/materials-characterization

Course Designers

1. Dr.R.Srinivasan
2. Dr.R.Dhanalakshmi

Thiagarajar College (Autonomous) :: Madurai – 625 009

Department of Physics

(For those joined M.Sc. Physics on or after June 2023)

PROGRAMME CODE: PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH23ET22	**ADVANCED OPTICS**	Elective -4	3	2	-	3

Year	Semester	Int. Marks	Ext.Marks	Total
First	Second	25	75	100

Preamble

- To know the concepts behind polarization and could pursue research work on application aspects of laser
- To impart an extensive understanding of fiber and non-linear optics
- To study the working of different types of LASERS
- To differentiate first and second harmonic generation
- Learn the principles of magneto-optic and electro-optic effects and its applications.

Prerequisite

Polarisation, Principle of Laser, Optical fiber communication etc.

Course Outcome

On the completion of the course the student will be able to

#	Course Outcome	Knowledge Level	Expected Proficiency	Expectd Attainment
CO1	Discuss the transverse character of light waves and different polarization phenomenon	K1	75	70
CO2	Discriminate all the fundamental processes involved in laser devices and to analyze the design and operation of the devices	**K2**	**75**	**70**
CO3	Demonstrate the basic configuration of a fiber optic – communication system and advantages	**K3, K4**	**75**	**70**
CO4	Identify the properties of nonlinear interactions of light and matter	**K4**	**75**	**70**

CO5	Interpret the group of experiments which depend for their action on an applied magnetics and electric field	**K5**	**75**	**70**
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate				

Mapping of Course Outcome with Programme Outcomes

#	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	S	S	S	M	S	L	M
CO2	S	M	S	L	S	M	L
CO3	S	S	M	S	M	L	M
CO4	S	S	L	M	S	M	S
CO5	S	S	S	M	L	M	L

Mapping of Course Outcome with Programme Specific Outcomes

#	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	M
CO2	S	S	L	L	M
CO3	S	L	S	L	M
CO4	S	M	M	M	L
CO5	S	L	L	M	M

Blooms Taxonomy: Assessment Pattern

Bloom's category	CA		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge-K1	15% (9)	15% (9)	15% (20)
Understand-K2	15% (9)	15% (9)	15% (20)
Apply-K3	30% (18)	30% (18)	30% (40)
Analyze – K4	20% (12)	20% (12)	20% (25)
Evaluate – K5	20% (12)	20% (12)	20% (25)
	60	**60**	**130**

ADVANCED OPTICS

Unit I Polarization and double refraction

Classification of polarization – Transverse character of light waves – Polarizer and analyzer – Malu's law – Production of polarized light – Wire grid polarizer and the polaroid – Polarization by reflection – Polarization by double refraction – Polarization by scattering – The phenomenon of double refraction – Normal and oblique incidence – Interference of polarized light: Quarter and half wave plates – Analysis of polarized light – Optical activity

Unit II Lasers

Basic principles – Spontaneous and stimulated emissions – Components of the laser – Resonator and lasing action – Types of lasers and its applications – Solid state lasers – Ruby laser – Nd:YAG laser – gas lasers – He-Ne laser – CO_2 laser – Chemical lasers – HCl laser – Semiconductor laser

Unit III Fiber optics

Introduction – Total internal reflection – The optical fiber – Glass fibers – The coherent bundle – The numerical aperture – Attenuation in optical fibers – Single and multi-mode fibers – Pulse dispersion in multimode optical fibers – Ray dispersion in multimode step index fibers – Parabolic-index fibers – Fiber-optic sensors: precision displacement sensor – Precision vibration sensor

Unit IV Non-linear optics

Basic principles – Harmonic generation – Second harmonic generation – Phase matching – Third harmonic generation – Optical mixing – Parametric generation of light – Self-focusing of light

Unit V Magneto-optics and electro-optics

Magneto-optical effects – Zeeman effect – Inverse Zeeman effect – Faraday effect – Voigt effect – Cotton-mouton effect – Kerr magneto-optic effect – Electro-optical effects – Stark effect – Inverse stark effect – Electric double refraction – Kerr electro-optic effect – Pockels electro-optic effect

Unit VI Professional components

Expert Lectures, Online Seminars - Webinars on Industrial Interactions/Visits, Competitive Examinations, Employable and Communication Skill Enhancement, Social Accountability and Patriotism.

Text Books

1. Laud, B.B. (2017): *Lasers and Non-linear Optics* (3rd ed.), New Age International (P) Ltd.
2. AjoyGhatak, A. (2017): *Optics* (6th ed.), McGraw-Hill Education Pvt. Ltd.
3. Silfvast, W.T. (1996): *Laser Fundamentals*, Cambridge University Press, New York
4. Peatros, J.: *Physics of Light and Optics*, A good (and free!) electronic book.
5. Saleh, B. and Teich, M.: *Fundamentals of Photonics*, Wiley-Interscience

Reference Books

1. Jenkins, F.S. and White, H.E. (1981): *Fundamentals of Optics*, (4th ed.), McGraw-Hill International Edition.
2. Meschede, D. (2004): *Optics, Light and Lasers*, Wiley-VCH.
3. Lipson, S. G. and Lipson, H. (2011): *Optical Physics* (4th ed.), Cambridge University Press.
4. Band, Y.B. (2006): *Light and Matter*, Wiley and Sons.
5. Guenther, R. (1990): *Modern Optics*, Wiley and Sons.

Web Resources

1. https://www.youtube.com/watch?v=WgzynezPiyc
2. https://www.youtube.com/watch?v=ShQWwobpW60
3. https://www.ukessays.com/essays/physics/fiber–optics–and–it-applications.php
4. https://www.youtube.com/watch?v=0kEvr4DKGRI
5. http://optics.byu.edu/textbook.aspx

Course Designers:

1. Dr. R.V. KRISHNAKUMAR
2. Dr. S. RAJAKARTHIHAN

Thiagarajar College (Autonomous) :: Madurai – 625 009

Department of Physics

(For those joined M.Sc. Physics on or after June 2023)

PROGRAMME CODE: PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH23AT21	Soft Professional Skills	AECC - 2	2	-	-	2

Year	Semester	Int. Marks	Ext.Marks	Total
First	Second	25	75	100

Preamble

The course helps in improving the soft professional skills and acquire knowledge about developing soft professional skills

Prerequisite

- Leadership, inter-personal relationship, ethics.

Course Outcome

#	Course Outcome	Knowledge Level	Expected Proficiency	Expectd Attainment
CO1	Know about the importance of interpersonal relationship	K1	80	75
CO2	Understand the importance of human relations.	K2	80	75
CO3	Acquire knowledge about leadership skills.	K3	80	75
CO4	Attain presentation and thinking skills.	K4	80	75
CO5	Comprehend the ethics of interview.	K3,K5	80	75

Mapping of Course Outcome with Programme Outcomes

#	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	L	M	S	S	L	S	S
CO2	L	M	S	S	L	S	S
CO3	L	M	S	S	L	S	S
CO4	L	M	S	S	L	S	S
CO5	L	M	S	S	L	S	S

Mapping of Course Outcome with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	L	M	S	L	S
CO2	L	M	S	L	S
CO3	L	M	S	L	S
CO4	L	M	S	L	S
CO5	L	M	S	L	S

Blooms Taxonomy: Assessment Pattern

	Bloom's taxonomy		
Category	**Continuous Assignment**		**End of Semester Marks**
	I Internal Marks	**II Internal Marks**	
Knowledge-K1	15% (5)	15% (5)	15% (10)
Understand-K2	15% (4)	15% (4)	15% (8)
Apply-K3	30% (9)	30% (9)	30% (18)
Analyze-K4	20% (6)	20% (6)	20% (12)
Evaluate-K5	20% (6)	20% (6)	20% (12)
Total Marks	**30**	**30**	**60**

SOFT PROFESSIONAL SKILLS

UNIT 1: Interpersonal Relationship

Introduction- Importance of interpersonal relationship skills –types of interpersonal relationship- uses of interpersonal relationship skill-factors affecting interpersonal relationship.

UNIT 2: Team Building

Introduction- importance of human relations- understanding behavior- characteristics of high performance teams

UNIT 3: Leadership

Meaning of leadership- importance of leadership-leadership relationship-functions and responsibilities of leadership

UNIT 4: Presentation & Thinking skills

Introduction-process-examples of presentation language- core thinking skills- categories of thinking.

UNIT 5: Employment communication

Introduction-writing CV – group discussion-interview

Text Books

1.Manmohan Joshi, Soft Skills - 1st edition, (2017).theebook company,Bookboon.

Reference Books

1. .Alex, K, Soft skills-Know yourself and know the world - Third revised edition, 2014, S.Chand company.

Web Resources

1. https://www.youtube.com/watch?v=gLdPR0SIxXs
2. https://www.youtube.com/watch?v=x60GHpQ8gJk&list=PLWPirh4EWFpFIElSxplDlEhRDZHkBD-0n

Course Designers

1. Dr. R.V.Krishnakumar
2. Dr.D.Yamini

Thiagarajar College (Autonomous) :: Madurai – 625 009

Department of Physics

(For those joined B.Sc. Physics on or after June 2023)

PROGRAMME CODE: PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH23ST21	SOLAR PHOTOVOLTAIC TECHNOLOGY	SEC-2	2	1	-	2

Year	Semester	Int. Marks	Ext.Marks	Total
I	Second	25	75	100

Preamble

- Introduce the basic physics and technology of photovoltaic science and systems for solar energy harnessing.

Prerequisite

Fundamental knowledge of semiconductors.

Course Outcome

On the completion of the course the student will be able to

#	Course Outcome	Knowledge Level	Expected Proficiency	Expectd Attainment
CO1	Know the present energy scenario and the importance of photovoltaics	K1, K2	80	75
CO2	Understand the science and technology of solar cells	K2	80	75
CO3	Appreciate various material properties which are used in photovoltaic devices	K3, K4	80	75
CO4	Appreciate the designing of solar cells	K4	80	75
CO5	Understand the designing of solar hybrid PV systems and its applications	K3, K5	80	75
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate				

Mapping of Course Outcome with Programme Outcomes

#	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	M	L	L	L	-	S	-
CO2	L	M	M	L	-	L	-
CO3	M	M	M	M	M	L	-
CO4	M	M	M	M	M	L	L
CO5	L	M	S	M	M	L	-

Mapping of Course Outcome with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	L	L	L	L
CO2	M	L	L	M	L
CO3	M	M	L	S	L
CO4	L	M	L	S	L
CO5	M	M	L	M	L

Blooms Taxonomy: Assessment Pattern

	Bloom's taxonomy		
Category	**Continuous Assignment**		**End of Semester Marks**
	I Internal Marks	**II Internal Marks**	
Knowledge-K1	15% (5)	15% (5)	15% (10)
Understand-K2	15% (4)	15% (4)	15% (8)
Apply-K3	30% (9)	30% (9)	30% (18)
Analyze-K4	20% (6)	20% (6)	20% (12)
Evaluate-K5	20% (6)	20% (6)	20% (12)
Total Marks	**30**	**30**	**60**

SOLAR PHOTOVOLTAIC TECHNOLOGY

Unit I: ENERGY SCENARIO

World energy requirement- need for sustainable energy sources-Sustainable Sun's energy-current status of renewable energy sources-place of photovoltaics in energy supply

Unit II: INTRODUCTION TO SOLAR CELLS

Introduction to PN junction diode-Equilibrium Condition-Non-equilibrium condition-PN junction diode under illumination: solar cell

Unit III: DESIGN OF SOLAR CELLS-I

Upper limit of cell parameters- losses in solar cells- solar cell design- Design for high I_{sc}-Design for high V_{oc}-Design for high FF

Unit IV: DESIGN OF SOLAR CELLS-II

Si based solar cell Technology: process flow of commercial Si Cell Technologies – high efficiency Si Solar cells. Thin film solar cell technologies: Common features of thin film Technologies

Unit V: EMERGING SOLAR CELL TECHNOLOGIES AND APPLICATIONS

Organic solar cells-Dye sensitized solar cells-GaAs solar cells-Thermo photovoltaics-introduction to solar PV systems-standalone PV system configurations-design methodology of PV systems-Hybrid PV systems.

Text Books

1. Chetan Singh Solanki, (2011). *Solar Photovoltaics: Fundamentals, Technologies and Applications* 2nd ed., Prentice Hall of India, New Delhi

Reference Books

1. Moller, H.J. (1993).*Semiconductors for solar cells*, Artech House Inc., MA, USA
2. Martin Green, (1997). S*olar Cells: Operating principles, Technology and Systems Applications*, UNSW, Australia

3. Larry D. Partain (1995). *Solar Cells and their Applications*, John Wiley and Sons, New York
4. Nelson, J. (2006). *The Physics of Solar Cells*, Imperial College Press
5. Richard H. Bube,(1998).*Photovoltaic Materials*, Imperial College Press

Web Resources

1. https://www.energy.gov/eere/solar/solar-photovoltaic-technology-basics
2. https://solareis.anl.gov/guide/solar/pv/index.cfm
3. https://www.eia.gov/energyexplained/solar/photovoltaics-and-electricity.php

Course Designers

Dr.J.Suvetha Rani

Thiagarajar College (Autonomous) :: Madurai – 625 009

Department of Physics

(For those joined B.Sc. Physics on or after June 2023)

PROGRAMME CODE: PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH23CL11	PRACTICAL – I	Lab	-	-	5	4

Year	Semester	Int. Marks	Ext.Marks	Total
I	First	40	60	100

Preamble

- To understand the concept of mechanical behavior of materials and calculation of the same using appropriate formulae.
- To calculate the thermodynamic quantities and physical properties of materials.
- To acquire knowledge on designing electronic circuits of practical applicability.

Prerequisite

Knowledge and hands on experience of basic general and electronics experiments of Physics.

Course Outcome

On the completion of the course the student will be able to

#	Course Outcome	Knowledge Level	Expected Proficiency	Expectd Attai nment
CO1	Understand the concept of Young's modulus, Ultrasonics, Interferometer.	K2	80	75
CO2	Acquire knowledge of thermal and electrical conductivity of the matetials.	**K1**	**80**	**75**
CO3	Understand diffraction of light by experiments.	**K2**	**80**	**75**
CO4	Conduct experiments on FET, UJT and Op amp.	**K1, K3**	**80**	**75**
CO5	Understand the concept of logic circuits, counters and	**K3, K5**	**80**	**75**

	registers			
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate				

Mapping of Course Outcome with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	M	S	M	S	L	M	M
CO2	S	M	M	L	M	L	S
CO3	M	S	L	M	L	S	M
CO4	M	M	L	S	S	L	S
CO5	S	M	M	L	S	S	M

Mapping of Course Outcome with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	M
CO2	M	M	M	S	L
CO3	S	S	M	L	S
CO4	S	S	M	M	S
CO5	S	M	S	M	L

PRACTICAL – I

List of experiments (any twelve).

1. Determination of Young's modulus and Poisson's ratio by Hyperbolic fringes - Cornu's Method.
2. Determination of Thickness of air film. - Solar spectrum – Hartmann's formula.
3. Determination of Planck Constant – LED Method.
4. Determination of Compressibility of a liquid using Ultrasonics.
5. Determination of Wavelength, Separation of wavelengths - Michelson Interferometer.
6. GM counter – Characteristics, inverse square law and absorption coefficient.
7. Measurement of Conductivity - Four probe method.
8. Measurement of wavelength of Diode Laser / He – Ne Laser using Diffraction grating.
9. Determination of Diffraction pattern of light with circular aperture using Diode/He-Ne laser.
10. Study the beam divergence, spot size and intensity profile of Diode/He-Ne laser.

11. Construction of relaxation oscillator using UJT.
12. FET CS amplifier- Frequency response, input impedance, output impedance.
13. Study of important electrical characteristics of IC741.
14. V- I Characteristics of different colours of LED.
15. Construction of Schmidt trigger circuit using IC 741 for a given hysteresis- application as squarer.
16. Construction of square wave Triangular wave generator using IC 741.
17. Construction of Op-Amp- 4 bit Digital to Analog converter (Binary Weighted and R/2R ladder type).
18. Study of R-S, clocked R-S and D-Flip flop using NAND gates.
19. Study of J-K, D and T flip flops using IC 7476/7473.
20. Arithmetic operations using IC 7483- 4-bit binary addition and subtraction.
21. Study of Arithmetic logic unit using IC 74181.
22. Construction of Encoder and Decoder circuits using ICs.

Text Books

1. Gupta, S.L., Kumar, V.(2017).*Practical Physics*, PragatiPrakasan, Meerut.
2. Srinivasan, R. Priolkar, K.R., (2013).*Kit Developed for doing experiments in Physics – Introduction manual*, Sponsored by Indian Academy of Sciences, Banglore,
3. Poornachandra, S. Sasikala, B. *Electronic Laboratory Primer a design approach*, Wheeler Publishing, New Delhi.
4. Navas, K.A.(2008).*Electronic lab manual*Vol I, Rajath Publishers, Kochi.
5. Navas, K.A.(2018). *Electronic lab manual*Vol II, Sixth ed., Eastern Economy Edition, New Delhi.

Reference Books

1. Singh, S.P. (2017). *Advanced Practical Physics*, PragatiPrakashan.
2. Chattopadhayay, D. Rakshit, C.R. (1990). *An advanced course in Practical Physics*, New Central Book Agency Pvt. Ltd.
3. Ramakanth A Gaykwad, (2015). *Op-Amp and linear integrated circuit*, Fourth ed., Eastern Economy Edition, New Delhi.
4. Sirohi, R.S., John, (2001). *A course on experiment with He-Ne Laser*, Second ed., New Age International (P) Limited, New Delhi, 2001.
5. Kuriachan, T.D. Syam Mohan, S. (2010). *Electronic lab manual Vol II*, Ayodhya Publishing.

Course Designers

1. Dr. G.Arivazhagan
2. Prof. M.Venkatachalam

Thiagarajar College (Autonomous) :: Madurai – 625 009

Department of Physics

(For those joined B.Sc. Physics on or after June 2023)

PROGRAMME CODE: PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH23CL21	**PRACTICAL – II**	Lab		-	5	4

Year	Semester	Int. Marks	Ext.Marks	Total
I	Second	40	60	100

Preamble

- To understand the concept of mechanical behavior of materials and calculation of the same using appropriate formulae.
- To calculate the thermodynamic quantities and physical properties of materials.
- To acquire knowledge on designing electronic circuits of practical applicability.

Prerequisite

Knowledge and hands on experience of basic general and electronics experiments of Physics.

Course Outcome

On the completion of the course the student will be able to

#	Course Outcome	Knowledge Level	Expected Proficiency	Expectd Attainment
CO1	Understand the concept of Young's modulus, linear expansion, dielectric, molecular and vibrational spectra.	K2	80	75
CO2	Acquire knowledge of magnetic susceptibility, hysteresis, Hall effect of the matetials.	K1	80	75
CO3	Understand diffraction and interference by experiments.	K2	80	75
CO4	Conduct experiments on Seven Segment, Op-amp, ADC, DAC and filters.	K1, K3	80	75
CO5	Understand the concept of square and pulse wave generator and counters.	K3, K5	80	75
K1 - Remember; K2 – Understand; K3 - Apply; K4 - Analyze; K5 – Evaluate				

Mapping of Course Outcome with Programme Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7
CO1	M	S	M	S	L	M	M
CO2	S	M	M	L	M	L	S
CO3	M	S	L	M	L	S	M
CO4	M	M	L	S	S	L	S
CO5	S	M	M	L	S	S	M

S=Strong, M=Medium and L=Low

Mapping of Course Outcome with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	S	M
CO2	M	M	M	S	L
CO3	S	S	M	L	S
CO4	S	S	M	M	S
CO5	S	M	S	M	L

PRACTICAL – II

List of experiments (any twelve).

1. Determination of Young's modulus and Poisson's ratio by Elliptical fringes - Cornu's Method
2. Determination of Stefan's constant of radiation from a hot body
3. Measurement of Coefficient of linear expansion- Air wedge Method
4. Measurement of Susceptibility of liquid - Quincke's method
5. B-H curve using CRO
6. Measurement of Magnetic Susceptibility - Guoy's method
7. LG Plate
8. Arc spectrum: Copper
9. Determination of Solar constant
10. Determination of e/m - Millikan's method
11. Miscibility measurements using ultrasonic diffraction method
12. Determination of Thickness of thin film. - Michelson Interferometer
13. GM counter – Feather's analysis: Range of Beta rays
14. Iodine absorption spectra

15. Molecular spectra – CN bands
16. Determination of Refractive index of liquids using diode Laser/ He – Ne Laser
17. Determination of Numerical Apertures and Acceptance angle of optical fibers using Laser Source.
18. Measurement of Dielectricity - Microwave test bench
19. Hall Effect in Semiconductor. Determine the Hall coefficient, carrier concentration and carrier mobility
20. Interpretation of vibrational spectra of a given material.
21. Determination of I-V Characteristics and efficiency of solar cell.
22. IC 7490 as scalar and seven segment display using IC7447
23. Solving simultaneous equations – IC 741 / IC LM324
24. Op-Amp –Active filters: Low pass, High pass and Band pass filters (Second Order) Batter worth filter
25. Construction of Current to Voltage and Voltage to Current Conversion using IC 741.
26. Construction of second order butter worth multiple feedback narrow band pass filter
27. Realization of analog to digital converter (ADC) using 4-bit DAC and synchronous counter IC74193
28. Construction of square wave generator using IC 555 – Study of VCO
29. Construction of Schmidt trigger circuit using IC555 for a given hysteresis – Application as squarer
30. Construction of pulse generator using the IC 555 – Application as frequency divider
31. BCD to Excess- 3 and Excess 3 to BCD code conversion
32. Study of binary up / down counters - IC 7476 / IC7473
33. Shift register and Ring counter and Johnson counter- IC 7476/IC 7474
34. Study of synchronous parallel 4-bit binary up/down counter using IC 74193
35. Study of asynchronous parallel 4-bit binary up/down counter using IC 7493
36. Study of Modulus Counter
37. Construction of Multiplexer and Demultiplexer using ICs.

Text Books

1. Gupta, S.L., Kumar, V.(2017).*Practical Physics*, PragatiPrakasan, Meerut.
2. Srinivasan, R. Priolkar, K.R., (2013).*Kit Developed for doing experiments in Physics – Introduction manual*, Sponsored by Indian Academy of Sciences, Banglore,
3. Poornachandra, S. Sasikala, B. *Electronic Laboratory Primer a design approach*, Wheeler Publishing, New Delhi.
4. Navas, K.A.(2008). *Electronic lab manual*Vol I, Rajath Publishers, Kochi.

5. Navas, K.A.(2018). *Electronic lab manual*Vol II, Sixth ed., Eastern Economy Edition, New Delhi.
6. Ramakanth A Gaykwad, (2015). *Op-Amp and linear integrated circuit*, Fourth ed., Eastern Economy Edition, New Delhi.

Reference Books

1. Singh, S.P. (2017). *Advanced Practical Physics*, PragatiPrakashan.
2. Chattopadhayay, D. Rakshit, C.R. (1990). *An advanced course in Practical Physics*, New Central Book Agency Pvt. Ltd.
3. Ramakanth A Gaykwad, (2015). *Op-Amp and linear integrated circuit*, Fourth ed., Eastern Economy Edition, New Delhi.
4. Sirohi, R.S., John, (2001). *A course on experiment with He-Ne Laser*, Second ed., New Age International (P) Limited, New Delhi, 2001.
5. Kuriachan, T.D. Syam Mohan, S. (2010). *Electronic lab manual Vol II*, Ayodhya Publishing.

Course Designers

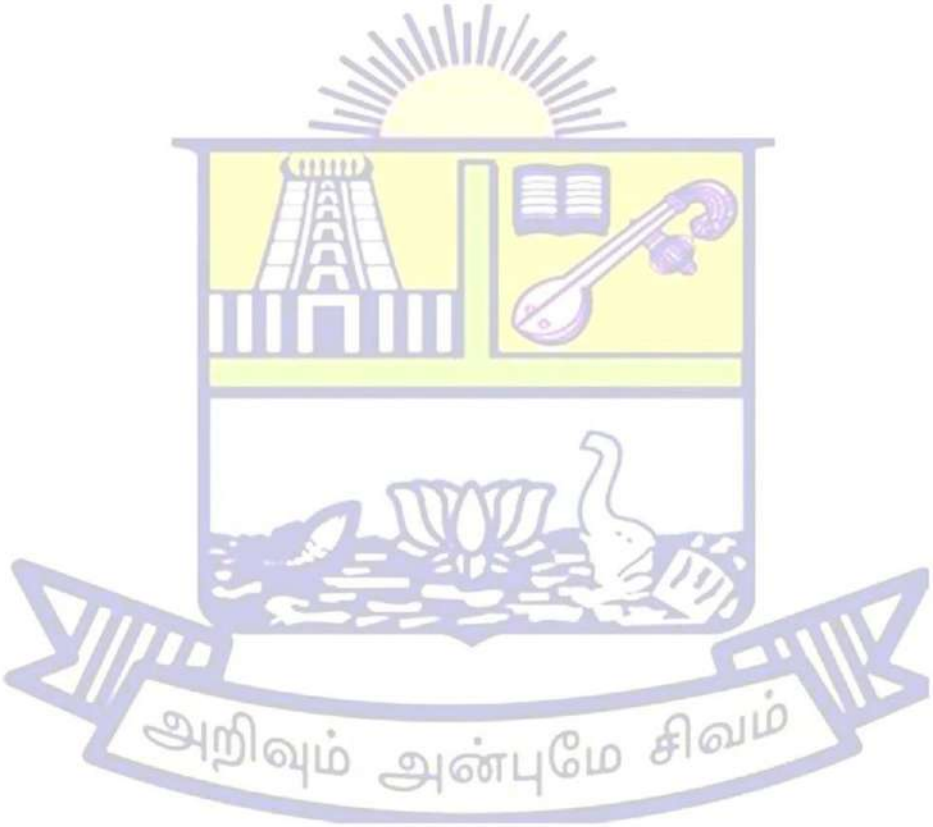
1. Dr. G.Arivazhagan
2. Prof. M.Venkatachalam

ThiagarajarCollege

(AnAutonomousInstitutionAffiliatedtoMaduraiKamarajUniversity)
Re-Accreditedwith‘A++ ’Grade by NAAC

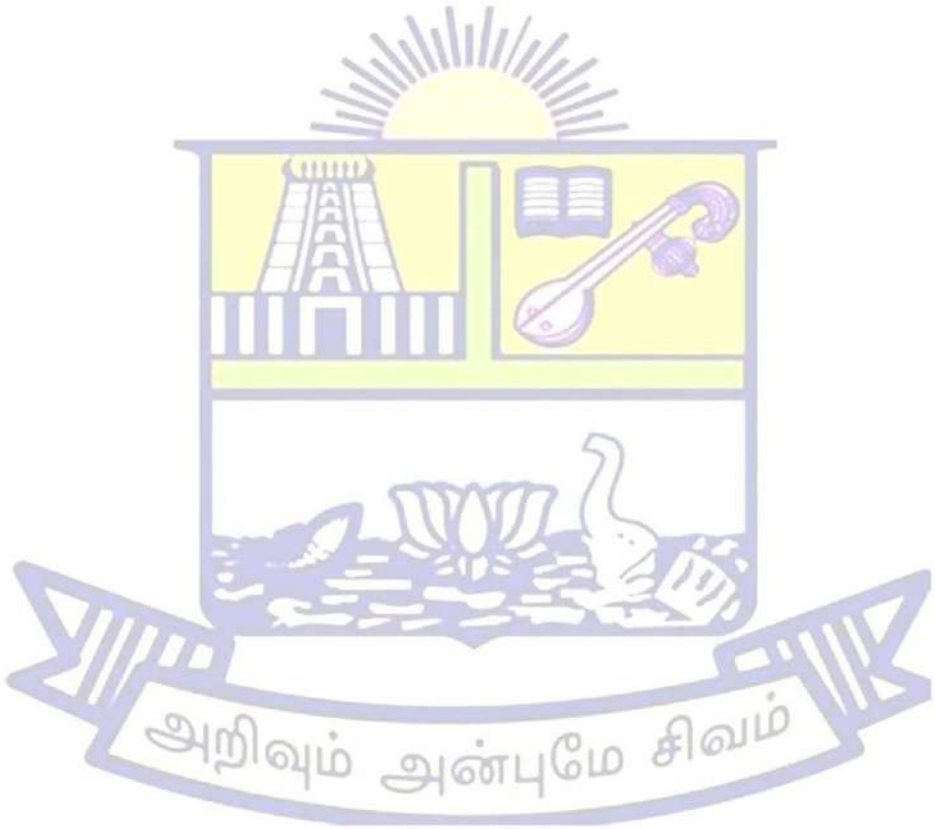
Academic Council Meeting (ACM)

June-2023



Department of Physics
B.Sc., Physics Syllabus
2023-2024

B.Sc. PHYSICS
ProgrammeCode– UPH
(Aided & SF)



Programme outcome (PO) Bachelor of Science (B.Sc.)

PO1 **Scientific Knowledge and Critical Thinking**

Apply the knowledge of Life Science, Physical and Chemical Science, Mathematics, statistics, Computer science and humanities for the arrangement of solutions to the problems that come across in our day-to-day life/activities

PO2 **Problem Solving**

Identify and analyse the problem and formulate solutions for problems using the principles of mathematics, natural sciences with appropriate consideration for the public health, safety and environmental considerations.

PO3 **Communication and Computer Literacy**

Communicate the fundamental and advanced concepts of their discipline in written and oral form. Able to make appropriate and effective use of information and information technology relevant to their technique.

PO4 **Life-Ling Learning**

Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PO5 **Ethical, Social and Professional Understanding**

Commitment to principles, codes of conduct and social responsibility in order to behave consistently with personal respect. Acquire the responsibility to contribute for the personal development and for the development of the community. Respect the ethical values, social responsibilities and diversity.

PO6 **Innovative, Leadership and Entrepreneur Skill Development**

Function as an individual and as a member or leader in diverse teams and in multidisciplinary settings. Become an entrepreneur by acquiring technical, communicative, problem solving and intellectual skills.

THIAGARAJAR COLLEGE, MADURAI – 625 009

An Autonomous Institution Affiliated to Madurai kamaraj University
Re-Accredited with A++ Grade by NAAC
Ranked 22rd in NIRF 2022

DEPARTMENT OF PHYSICS

LIGHT

Learn with focus

Innovate for a cause

be **G**rateful

be **H**umane

Transform dreams into reality

VISION

To provide an ambient environment for teaching and research in physics with focus on achieving academic excellence

MISSION

- To contribute to develop and sustain teaching and evaluation methods in physics learning in tune with emerging trends in science
- To constantly explore and enhance research potential among faculty and students to promote innovation
- To bridge the gap between curriculum-based learning and career readiness/employability of physics graduates
- To create a conscientious awareness among students about issues pertaining to welfare of society and environment

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

- The objectives of this programme is to equip/prepare students to

PEO1	A successful career in academia, government, industry, corporates or as an self-employed entrepreneur
PEO2	Continue to learn and advance in academia to undertake higher education with focus on research and development
PEO3	Communicate physics related topics effectively by way of oral presentations and write-ups in the form of scientific reports, projects, dissertations, etc.
PEO4	Acknowledge the importance of participation in co-curricular and etra-curricular activities to nurture and grow leadership skills
PEO5	Be socially sensitive to contemporary issues and play a constructive role towards the welfare of the society and environment

-

PROGRAMME SPECIFIC OUTCOMES – B.Sc. PHYSICS

- On successful completion of B.Sc. Physics, the students will be able to

PSO1	Identify key concepts, principles and fundamental laws that are central to the study of various areas of physics, define and describe them with clarity
PSO2	Demonstrate the application of physics principles, concepts and laws with necessary experimental background and assess their consequences
PSO3	Explain the mathematical foundation of the underlying physics principles, concepts and laws
PSO4	Formulate, discuss and analyse problems in physics by identifying key concepts and principles to solve them
PSO5	Plan and execute an experiment through careful observations, precise measurements, analysis, interpretation and effectively communicate the results

THIAGARAJAR COLLEGE, MADURAI – 9
Bachelor of Science (B.Sc. Physics) (w.e.f. 2023 batch onwards)
Department of Physics Programme Code : UPH
Semester – I

Course	Code	Subject	Contact hours per week	Credits	Total No. of hours allotted	Maximum Marks		Total
						CA	SE	
Part – I	U23P1TA11B	பொதுத் தமிழ் ஏ I / Other Language	6	3	90	25	75	100
Part – II	U23P2EN11	General English -I	4	3	60	25	75	100
Core–1	UPH23CT11	Properties of Matter and Sound	4	3	60	25	75	100
Core–2	UPH23CT12	Heat,Thermodynamics and Statistical Physics	3	3	45	25	75	100
Core Lab 1	UPH23CL11	Major Practical – I	2	2	30	25	75	100
Generic Elective	UMA23GT11P	Ancillary Mathematics	5	3	75	25	75	100
NME	UPH23NT11	Home Electrical Installations	2	2	30	25	75	100
AECC – I	UEN23AT11	Introduction to Personality Development - I	2	2	30	25	75	100
FC	UPH23FT11	Introductory Physics	2	2	30	25	75	100
			30	**23**	**450**			

Semester – II

Course	Code	Subject	Contact hours per week	Credits	Total No. of hours allotted	Maximum Marks		Total
						CA	SE	
Part – I	U23P1TA21	Tamil / Other Language	6	3	90	25	75	100
Part – II	U23P2EN21	English	4	3	90	25	75	100
Core–3	UPH23CT21	Mechanics	4	3	60	25	75	100
Core–4	UPH23CT22	Optics and Spectroscopy	3	3	45	25	75	100
Core Lab 2	UPH23CL21	Major Practical - II	2	2	30	25	75	100
Generic Elective	UMA23GT21P	Ancillary Mathematics	3	2	45	25	75	100
NME	UPH23NT21	Physics for Everyday life	2	2	30	25	75	100
SEC – I DSE	UPH23ST21	Energy Physics	2	2	30	25	75	100
AECC – II	UEN23AT21	Employability Skills	2	2	30	25	75	100
			30	**23**	**450**	**180**	**470**	**650**
Extra Credit	U23NM21	**Naan Mudhalvan Scheme Language Proficiency for Employability**		**2**				

Thiagarajar College (Autonomous), Madurai – 625 009

Department of Physics

(For those joined B.Sc. Physics on or after June 2023)

PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH23CT11	**PROPERTIES OF MATTER AND SOUND**	Core-1	3	1	-	3

Year	Semester	Int. Marks	Ext. Marks	Total
I	FIRST	25	75	100

Preamble

A study of the properties of matter leads to information which is of practical value to both the physicist and the engineers.It gives us information about the internal forces which act between the constituent parts of the substance. Students who undergo this course are successfully bound to get a better insight and understanding of the subject.

Prerequisite

Elasticity, Sound, Ultrasonics, Waves, oscillations

Course Outcome

On the completion of the course the student will be able to

#	Course Outcome	K Level	Expected Proficiency%	Expected Attainment%
CO1	Learning the basics concepts of elasticity, Young's modulus and also study the elastic behavior & working of torsional pendulum.	K1	80	75
CO2	Study of bending behavior beams and analyses the expression for young's modulus with experimental methods.	K2	80	75
CO3	Understand the surface tension and viscosity of fluid.	K2	80	75
CO4	Understand the concepts of waves and oscillations.	K2	80	75
CO5	Acquire the knowledge about acoustics of buildings and ultrasonic waves.	K3	80	75

Mapping of Course Outcome with Programme Outcomes

#	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	S	S	M
CO2	S	M	M	M	M	L
CO3	S	M	M	M	M	M
CO4	S	M	M	M	L	S
CO5	S	S	S	L	S	L

Mapping of Course Outcome with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	M	S	S
CO2	M	S	M	L	L
CO3	S	M	L	M	M
CO4	M	S	L	M	S
CO5	M	L	S	M	M

Blooms Taxonomy: Assessment Pattern

Bloom's category	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

PROPERTIES OF MATTER AND SOUND

Unit I ELASTICITY: Introduction–Hooke's law – stress-strain diagram - elastic constants –Poisson's ratio – relation between elastic constants and Poisson's ratio – work done in stretching and twisting a wire –twisting couple on a cylinder – rigidity modulus by static torsion–torsional pendulum (with and without masses)

Unit II BENDING OF BEAMS: Cantilever– expression for Bending moment – expression for depression at the loaded end of the cantilever– oscillations of a cantilever – expression for time period –experiment to find Young's modulus – non-uniform bending– experiment to determine Young's modulus by (using pin and microscope)– uniform bending – expression for elevation – experiment to determine Young's modulus using microscope.

Unit III FLUID DYNAMICS: Surface tension: definition – molecular forces– excess pressure over curved surface – application to spherical and cylindrical drops and bubbles – determination of surface tension by Jaegar's method–variation of surface tension with temperature-Drop weight method of determining the surface tension of a liquid– Interfacial tension-experiment to determine interfacial tension between water and kerosene. Viscosity: Definition – streamline and turbulent flow – rate of flow of liquid in a capillary tube – Poiseuille's formula –corrections –terminal velocity and Stoke's formula– variation of viscosity with temperature

Unit IV WAVES AND OSCILLATIONS: Simple Harmonic Motion (SHM)– differential equation of SHM – graphical representation of SHM –composition of two SHM in a straight line and at right angles –Lissajous figures- free, damped, forced vibrations –resonance and Sharpness of resonance. Laws of transverse vibration in strings – sonometer – determination of AC frequency using sonometer –determination of frequency using Melde's string apparatus.

Unit V: ACOUSTICS OF BUILDINGS AND ULTRASONICS: Intensity of sound – decibel – loudness of sound –reverberation –Sabine's reverberation formula – acoustic intensity – factorsaffecting the acoustics of buildings. Ultrasonic waves: production of ultrasonic waves – Piezoelectric crystal method – magnetostriction effect – application of ultrasonic waves.

Text Books

1. Mathur, D.S. (2010). *Elements of Properties of Matter*, S.Chand& Co.
2. BrijLal&Subrahmanyam, N. (2003).*Properties of Matter*, S.Chand& Co
3. D.R.Khanna&Bedi, R.S.(1969).*Textbook of Sound*, AtmaRam& sons
4. BrijLal&Subrahmanyam, N. (1995).*A Text Book of Sound*, Second revised edition,Vikas Publishing House.
5. Murugesan, R. (2012).*Properties of Matter*, S.Chand& Co.

Reference Books

1. Smith, C.J. (1960).*General Properties of Matter*, Orient Longman Publishers
2. Gulati, H.R. (1977).*Fundamental of General Properties of Matter*, Fifth edition,R. Chand & Co.
3. French, A.P. (1973).*Vibration and Waves, MIT Introductory Physics*, Arnold-Heinmann India.

https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work

Web Resources

1. http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.html
2. https://www.youtube.com/watch?v=gT8Nth9NWPM
3. https://www.youtube.com/watch?v=m4u-SuaSu1s&t=3s
4. https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work
5. https://learningtechnologyofficial.com/category/fluid-mechanics-lab/
6. http://www.sound-physics.com/
7. http://nptel.ac.in/courses/112104026

Course Designers

1. Dr. V. Rajniswamy
2. Mr. S. Alaguraja
3. Dr. D. Saravanakkumar
4. Dr. R. Sangeetha

Thiagarajar College (Autonomous), Madurai – 625 009

Department of Physics

(For those joined B.Sc. Physics on or after June 2023)

PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH23CT12	HEAT, THERMODYNAMICS AND STATISTICAL PHYSICS	Core-2	3	-	-	3

Year	Semester	Int. Marks	Ext. Marks	Total
I	FIRST	25	75	100

Preamble

The course focuses to understand a basic in conversion of temperature in Celsius, Kelvin and Fahrenheit scales. Practical exhibition and explanation of transmission of heat in good and bad conductor. Relate the laws of thermodynamics, entropy in everyday life and explore the knowledge of statistical mechanics and its relation

Prerequisite

Heat capacity, Carnot Engine, Entropy, Conduction, Convection, Radiation

Course Outcome

On the completion of the course the student will be able to

#	Course Outcome	K Level	Expected Proficiency %	Expected Attainment%
CO1	Acquires knowledge on how to distinguish between temperature and heat. Student identifies the relationship between heat capacity, specific heat capacity. The study of Low temperature Physics sets the basis for the students to understand cryogenics, superconductivity, superfluidity and Condensed Matter Physics	K1	80	75
CO2	Derive the efficiency of Carnot's engine. Discuss the implications of the laws of Thermodynamics in diesel and petrol engines	K2	80	75
CO3	Able to analyze performance of thermodynamic systems viz efficiency by problems. Gets an	K2	80	75

	insight into thermodynamic properties like enthalpy, entropy			
CO4	Study the process of thermal conductivity and apply it to good and bad conductors. Quantify different parameters related to heat, relate them with various physical parameters and analyse them	K2	80	75
CO5	Interpret classical statistics concept, Maxwell-Boltzmann distribution law. Develop the statistical interpretation of Bose-Einstein and Fermi-Dirac .	K3	80	75

Mapping of Course Outcome with Programme Outcomes

#	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	S	S	S
CO2	M	S	S	S	M	S
CO3	S	S	S	M	S	S
CO4	S	S	S	S	S	S
CO5	S	S	M	S	S	S

Mapping of Course Outcome with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S
CO2	S	S	M	S	S
CO3	S	M	S	S	S
CO4	S	S	S	S	S
CO5	M	S	S	S	M

Blooms Taxonomy: Assessment Pattern

Bloom's category	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

HEAT, THERMODYNAMICS AND STATISTICAL PHYSICS

UNIT I -CALORIMETRY: Specific heat capacity – specific heat capacity of gases CP & CV– Meyer's relation. **LOW TEMPERATURE PHYSICS:** Joule-Kelvin effect – porous plug experiment –Joule-Thomson effect –liquefaction of gas by Linde's Process

UNIT II - THERMODYNAMICS - I:zeroth law and first law of thermodynamics – P-V diagram - phase changing materials (Introduction) – heat engine –efficiency of heat engine – Carnot's engine, construction, working and efficiency.

UNIT III -THERMODYNAMICS - II: second law of thermodynamics –entropy of an ideal gas – entropy change in reversible and irreversible processes – T-S diagram – Maxwell's thermodynamical relations –Clasius-Clapeyron's equation (first latent heat equation) – third law of thermodynamics – unattainability of absolute zero – heat death.

UNIT IV - HEAT TRANSFER: modes of heat transfer: conduction, convection and radiation. **Conduction:** thermal conductivity- determination of thermal conductivity of a bad conductor by Lee's disc method. **Radiation:** black body radiation (Ferry's method) – Wien's law and Rayleigh Jean's law –Planck's law of radiation – Stefan's law – deduction of Newton's law of cooling from Stefan's law.

UNIT V - STATISTICAL MECHANICS: definition of phase-space – micro and macro states – classical and quantum Statistics – Maxwell-Boltzmann statistics – Bose-Einstein statistics – Fermi-Dirac statistics – comparison of three statistics.

Text Books

1. Brijlal&Subramaniam, N. (2000).*Heat and Thermodynamics*, S.Chand& Co.
2. Narayanamoorthy& KrishnaRao, (1969). *Heat*,Triveni Publishers, Chennai.
3. KhannaV.R.&Bedi,R.S.(1998). 1st Edition, *Text book of Sound*, Kedharnaath Publish & Co, Meerut
4. Brijlal&Subramaniam, N.(2001).*Waves and Oscillations*, Vikas Publishing House, New Delhi.
5. Ghosh, (1996).*Text Book of Sound*, S.Chand& Co.
6. MurugeshanR. &KiruthigaSivaprasath,(2004). *Thermal Physics*, S. Chand&Co..

Reference Books

1. RajamJ.B.&Arora, C.L. (1976).*Heat and Thermodynamics*, 8th edition, S.Chand& Co. Ltd.
2. Mathur, D.S.*Heat and Thermodynamics*, Sultan Chand & Sons.

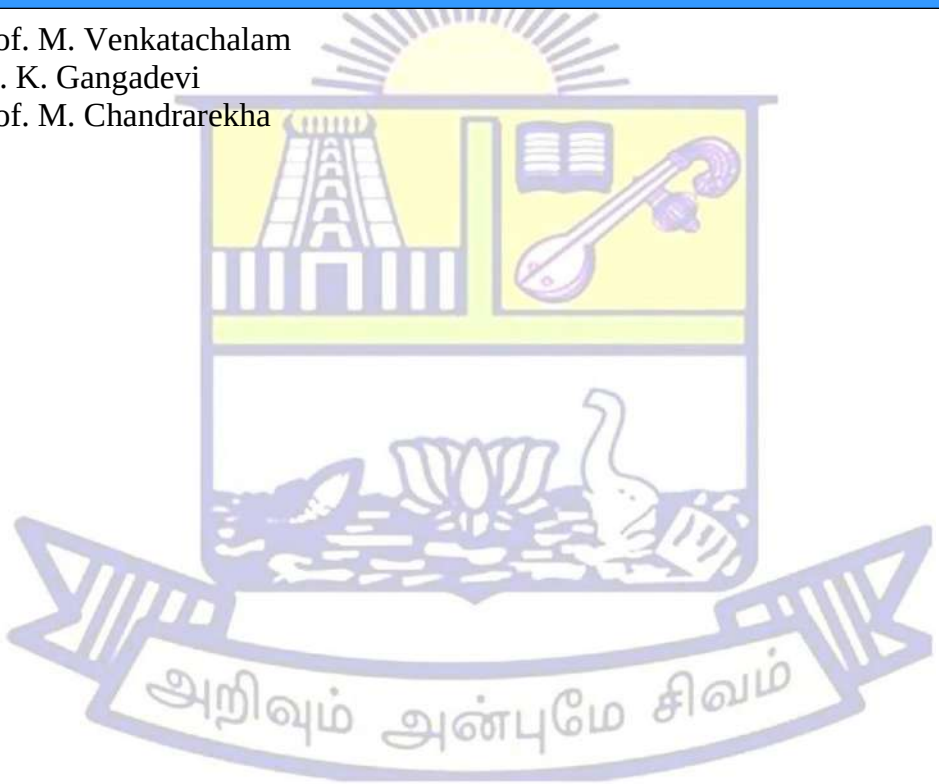
3. Gupta, Kumar, Sharma, (2013).*Statistical Mechanics*, 26th Edition, S. Chand & Co.
4. Resnick, Halliday&Walker, (2010).*Fundamentals of Physics*, 6th Edition.
5. Sears, Zemansky, Hugh D. Young,Roger A. Freedman, (2021).*University Physics with Modern Physics* 15th Edition, Pearson.

Web Resources

1. https://youtu.be/M_5KYncYNyc
2. https://www.youtube.com/watch?v=4M72kQulGKk&vl=en

Course Designers

1. Prof. M. Venkatachalam
2. Dr. K. Gangadevi
3. Prof. M. Chandrarekha



Thiagarajar College (Autonomous) :: Madurai – 625 009

Department of Physics

(For those joined B.Sc. Physics on or after June 2023)

PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH23NT11	HOME ELECTRICAL INSTALLATION	NME	2	-	-	2

Year	Semester	Int. Marks	Ext.Marks	Total
I	FIRST	25	75	100

Preamble

Understand the principles behind the transmission of electricity and electrical wiring and know the precautions while using electrical wires and appliances.

Prerequisite

Knowledge on electricity, power, resistance, installations

Course Outcome

#	Course Outcome	K Level	Expected Proficiency%	Expected Attainment%
CO1	Understand about simple Electrical circuits.	K1,K2	85	80
CO2	Know the principles behind the transmission of Electricity	K1	85	80
CO3	Understand the theory behind electrical wiring.	K2	85	80
CO4	Know the theory of power rating and power delivered	K2	85	80
CO5	Understand the Safety measures while using electrical wires and appliances.	K2,K3	85	80

Mapping of Course Outcome with Programme Outcomes

#	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	M	S	M	M
CO2	S	S	M	M	M	L
CO3	S	M	S	M	L	M
CO4	M	S	M	M	L	M
CO5	S	M	S	M	M	L

Mapping of Course Outcome with Programme Specific Outcomes

#	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	M	M	L
CO2	S	M	S	M	M
CO3	M	S	M	M	L
CO4	S	M	M	L	M
CO5	M	M	L	S	M

Blooms Taxonomy: Assessment Pattern

Bloom's category	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

HOME ELECTRICAL INSTALLATION

Unit I: SIMPLE ELECTRICAL CIRCUITS

charge, current, potential difference, resistance – simple electrical circuits – DC ammeter, voltmeter, ohmmeter – Ohm's law – difference between DC and AC –advantages of AC over DC – electromagnetic induction - transformers– inductors/chokes – capacitors/condensers – impedance – AC ammeter, voltmeter –symbols and nomenclature

Unit II: TRANSMISSION OF ELECTRICITY

Production and transmission of electricity – concept of power grid – Series and parallel connections– technicalities of junctions and loops in circuits –transmission losses

(qualitative) – roles of step-up and step-down transformers – quality of connecting wires – characteristics of single and multicore wires

Unit III: ELECTRICAL WIRING

Different types of switches – installation of two way switch – role of sockets, plugs, sockets - installation of meters – basic switch board – electrical bell – indicator – fixing of tube lights and fans – heavy equipment like AC, fridge, washing machine, oven, geyser, jet pumps – provisions for inverter – gauge specifications of wires for various needs

Unit IV: POWER RATING AND POWER DELIVERED:

Conversion of electrical energy in to different forms – work done by electrical energy– power rating of electrical appliances – energy consumption –electrical energy unit in kWh – calculation of EB bill – Joule's heating– useful energy and energy loss – single and three phase connections –Measures to save electrical energy – energy audit

Unit V: SAFETY MEASURES:

Insulation for wires – colour specification for mains, return and earth – Understanding of fuse and circuit breakers –types of fuse: kit-kat, HRC, cartridge, MCB, ELCB – purpose of earth line – lighting arrestors – short circuiting and over loading – electrical safety – tips to avoid electrical shock – first aid for electrical shock –fire safety for electric current

Text Books

1. Rex Cauldwell (2014). *Wiring a House*: 5th Edition. Taunton Press.
2. Black & Decker (2018).*Advanced Home Wiring*, 5th Edition: Backup Power - Panel Upgrades - AFCI Protection – "Smart" Thermostats. by Editors of Cool Springs Press.
3. Kevin Ryan (2022).*Complete Beginners Guide to Rough in Electrical Wiring*. Independently published.

Reference Books

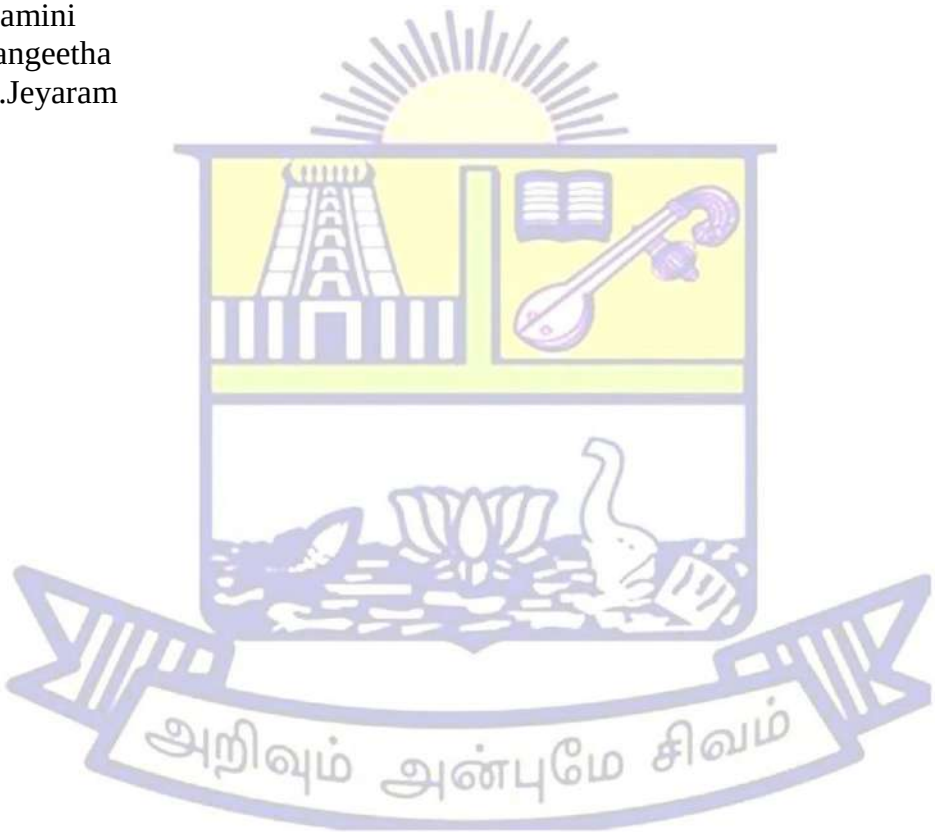
1. Philip Kiameh(2003). *Electrical Equipment Handbook*: *Troubleshooting and Maintenance*Mc GRAW- HILL New Delhi
2. Rao, S. (2010). *Testing Commissioning Operation & Maintenance of Electrical Equipment*- Khanna Publishers-
3. Jose Robin G. &Ubald Raj A. (2013).*Maintenance of Electrical Equipments*First Edition,Indira Publication Marthandam

Web Resources

1. https://www.youtube.com/watch?v=3JaxRPQkGMk
2. http://hyperphysics.phy-astr.gsu.edu/hbase/electric/hsehld.html
3. https://en.wikipedia.org/wiki/Home_appliance
4. https://www.electricveda.com/book/electric-appliances

Course Designers

1. Mr.S.Alaguraja
2. Dr.D.Yamini
3. Dr.R.Sangeetha
4. Dr.R.A.Jeyaram



Thiagarajar College (Autonomous) :: Madurai – 625 009

Department of Physics

(For those joined B.Sc. Physics on or after June 2023)

PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH23FT11	**INTRODUCTORY PHYSICS**	Core	2		-	2

Year	Semester	Int. Marks	Ext.Marks	Total
I	First	25	75	100

Preamble

- To Know the concept of Vectors and Scalars.
- To Understand about different types of Forces, Energy and Motions.

Prerequisite

Scalar, Vector, Energy, Force, Angular momentum.

Course Outcome

#	Course Outcome	K Level	Expected Proficiency%	Expected Attainment%
CO1	Apply Concept of Vectors to understand Concepts of Physics and Solve problems.	K1	85	80
CO2	Appreciate Different Forces Present in Nature while learning about phenomena related to these different forces.	K2	85	80
CO3	Quantify Energy in Different process and relate Momentum, Velocity and Energy.	K2	85	80
CO4	Differentiate different types of Motions they would encounter in various courses and understand their basis.	K3	85	80
CO5	Relate Various Properties of matter with their behavior and connect them with different Physical parameters involved.	K3	85	80

Mapping of Course Outcome with Programme Outcomes

#	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	M	S	S
CO2	M	S	S	S	M	S
CO3	S	S	M	S	S	S
CO4	S	S	S	S	S	M
CO5	S	M	S	S	S	S

Mapping of Course Outcome with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	L	M	M	M
CO2	M	L	M	L	S
CO3	M	L	M	S	L
CO4	S	M	L	M	L
CO5	M	S	L	L	M

Blooms Taxonomy: Assessment Pattern

Bloom's category	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

FOUNDATION COURSE : INTRODUCTORY PHYSICS

UNIT-I Vectors and Scalars: Vectors, Scalars –examples for scalars and vectors from physical quantities – Addition, subtraction of vectors – Resolution and resultant of vectors – Units and dimensions– Standard physics constants.

UNIT-II Types of Forces: Different types of forces–gravitational, electrostatic, magnetic, electromagnetic, nuclear – Mechanical forces like, centripetal, centrifugal, friction, tension, cohesive, adhesive forces.

UNIT-III Types of Energy: Different forms of energy– Conservation laws of momentum, energy – Types of collisions –Angular momentum– Alternate energy sources–Real life examples.

UNIT-IV Types of Motion: Linear, projectile, circular, angular, simple harmonic motions – satellite motion – Banking of a curved roads – Stream line and turbulent motions – Wave motion – Comparison of light and sound waves – Free, forced, damped oscillations.

UNIT-V Properties of Liquids: Surface tension – Shape of liquid drop – Angle of contact – Viscosity –Lubricants – Capillary flow – Diffusion – Real life examples– Properties and types of materials in daily use- conductors, insulators – thermal and electric.

Text Books

1. Mathur,D.S. (2010).*Elements of Properties of Matter*, S. Chand & Co
2. BrijLal& N. Subrahmanyam, (2003).*Properties of Matter*, S. Chand & Co.

Reference Books

1 Gulati, .H.R. (1977).*Fundamental of General Properties of Matter*, Fifth edition, S.Chand& Co.

Web Resources

1. http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.htmlhttps://science.nasa.gov/ems/
2. https://eesc.columbia.edu/courses/ees/climate/lectures/radiation_hays/

Course Designers

Dr. S. Rajakarthihan

Thiagarajar College (Autonomous), Madurai – 625 009

Department of Physics

(For those joined B.Sc. Physics on or after June 2023)

PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH23CT21	MECHANICS	Core	3	1	-	3

Year	Semester	Int. Marks	Ext.Marks	Total
First	Second	25	75	100

Preamble

This course allows the students: To have a basic understanding of the laws and principles of mechanics; To apply the concepts of forces existing in the system; To understand the forces of physics in everyday life; To visualize conservation laws; To apply Lagrangian equation to solve complex problems.

Prerequisite

Newton's law of motion, gravitation, conservation laws.

Course Outcome

On the completion of the course the student will be able to

#	Course Outcome	K Level	Expected Proficiency%	Expected Attainment%
CO1	Understand the Newton's Law of motion, understand the gravitation of earth and its potential.	K1,K2	80	75
CO2	Acquire the knowledge on the conservation laws	K2	80	75
CO3	Apply conservation law and calculate energy of various systems, understand and differentiate conservative and non-conservative forces	K2,K3	80	75
CO4	Gain knowledge on rigid body dynamics and solve problems based on this concept	K2	80	75
CO5	Appreciate Lagrangian system of mechanics, apply D' Alembert's principle.	K3	80	75

Mapping of Course Outcome with Programme Outcomes

#	PO1	PO2	PO3	PO4	PO5	PO6
CO1	L	L	L	M	S	-
CO2	M	M	M	L	L	-
CO3	S	M	L	M	M	-
CO4	S	S	M	L	L	M
CO5	L	S	M	-	-	S

Mapping of Course Outcome with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	L	M	M	L	M
CO2	M	S	M	M	M
CO3	M	M	S	M	M
CO4	S	M	L	L	M
CO5	L	M	L	L	M

Blooms Taxonomy: Assessment Pattern

Bloom's category	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

MECHANICS

Unit I: LAWS OF MOTIONAND GRAVITATION: Newton's Laws– forces – equations of motion – frictional force – motion of a particle in a uniform gravitational field – types of everyday forces in Physics.
Gravitation: Classical theory of gravitation–Kepler's laws, Newton's law of gravitation – Determination of G by Boy's method– gravitational potential – velocity of escape – satellite potential and kinetic energy –Einstein's theory of gravitation – introduction – principle of equivalence.

Unit II: CONSERVATION LAWS OF LINEAR AND ANGULAR MOMENTUM: conservation of linear and angular momentum – Internal forces and momentum conservation – center of mass – examples **–** conservation of angular momentum – torque due to internal forces – torque due to gravity – angular momentum about center of mass.

Unit III: CONSERVATION LAWS OF ENERGY: Introduction – significance of conservation laws – law of conservation of energy concepts of work- power – energy – conservative forces – potential energy and conservation of energy in gravitational and electric field – examples – non-conservative forces.

Unit IV: RIGID BODY DYNAMICS: Translational and rotational motion – angular momentum – moment of inertia – examples of circular disc, rectangular lamina, thin uniform bar(rod), solid sphere - general theorems of moment of inertia (theorem of perpendicular and parallel axis)– rotation about fixed axis – kinetic energy of rotation – examples – body rolling along a plane surface – body rolling down an inclined plane.

Unit V: LAGRANGIAN MECHANICS: Generalized coordinates –degrees of freedom – constraints - principle of virtual work and D' Alembert's Principle –Lagrange's equation from D' Alembert's principle – application –simple pendulum – Atwood's machine.

Text Books

1. Upadhyaya, J.C. (2019).*Classical Mechanics*, Himalaya Publishing house, Mumbai.
2. DuraiPandian, P. LaxmiDuraiPandian, Muthamizh Jayapragasam, (2005). *Mechanics*, 6th revised edition, S.Chand & Co.

3. Mathur D. S. & Hemne, P. S. (2000). Mechanics, Revised Edition, S.Chand& Co.
4. Narayanamurthi, M.&Nagarathnam. N, (1998).*Dynamics.* The National Publishing,Chennai.
5. Narayanamurthi, M. and Nagarathnam, N, (1982).*Statics, Hydrostatics and Hydrodynamics*,The National Publishers, Chennai.

Reference Books

1. Goldstein Herbert, (1980). *Classical Mechanics.* U.S.A: Addison and Wesely.
2. Halliday, David & Robert, Resnick,(1995). *Physics Vol.I.* New Age, International, Chennai.
3. Halliday, David Robert Resnick and Walker Jearl, (2001).*Fundamentals of Physics*, John Wiley, New Delhi.

Web Resources

1. https://youtu.be/X4_K-XLUIB4
2. https://nptel.ac.in/courses/115103115
3. https://www.youtube.com/watch?v=p075LPq3Eas
4. https://www.youtube.com/watch?v=mH_pS6fruyg
5. https://onlinecourses.nptel.ac.in/noc22_me96/preview
6. https://www.youtube.com/watch?v=tdkFc88Fw-M
7. https://onlinecourses.nptel.ac.in/noc21_me70/preview

Course Designers

1. Dr.S.Rajakarthihan
2. Mr.S.Alaguraja
3. Mrs.M.Chandrarekha

Thiagarajar College (Autonomous), Madurai – 625 009

Department of Physics

(For those joined B.Sc. Physics on or after June 2023)

PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH23CT22	OPTICS AND SPECTROSCOPY	Core	3	-	-	3

Year	Semester	Int. Marks	Ext. Marks	Total
I	SECOND	25	75	100

Preamble

The course provides an in-depth understanding of the basics of various phenomena in geometrical and wave optics; To explain the behaviour of light in different mediums; To understand the differences in the important phenomena namely interference, diffraction and Polarization and apply the knowledge in day to day life; To understand the design of optical systems and methods to minims aberrations; To solve problems in optics by selecting the appropriate equations and performing numerical or analytical calculations.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	K Level	Expected Proficiency%	Expected Attainment%
CO1	Outline basic knowledge of methods of rectifying different defects in lenses, articulate technological applications of resolving power	K1	80	75
CO2	Discuss the principle of superposition of wave, use these ideas to understand the wave nature of light through working of interferometer	K2	80	75
CO3	Extend the knowledge about nature of light through diffraction techniques; apply mathematical principles to analyse the optical instruments	K2,K3	80	75
CO4	Interpret basic formulation of polarization and gain knowledge about polarimeter, appraise its usage in industries	K3	80	75
CO5	Relate the principles of optics to various fields of IR, and Raman spectroscopy and understand their instrumentation and application in industries	K3	80	75

Mapping of Course Outcomes with Programme Outcomes

#	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	S	M	M	M
CO2	M	S	M	S	M	S
CO3	S	M	S	S	S	M
CO4	S	M	S	M	M	S
CO5	S	M	S	M	S	S

Mapping of Course Outcomes with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	M	S
CO2	M	S	M	S	M
CO3	S	S	S	M	S
CO4	S	M	M	S	M
CO5	S	M	S	S	M

Blooms taxonomy: Assessment Pattern

Bloom's category	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Syllabus: Optics and Spectroscopy

UNIT I:LENS AND PRISMS:

Lens: thick and thin lenses-lens maker`s formula. **Prism:** dispersion-deviation - applications-rainbows and halos. **Resolving power:** Rayleigh's criterion for resolution – limit of resolution for the eye – resolving power of (i) Prism (ii) grating (iii) telescope.

UNIT – II – INTERFERENCE: Division of wave front, Fresnel's biprism – fringes with white light – division of amplitude: interference in thin films due to, (i) reflected light, (ii) transmitted light – colours of thin films applications – air wedge – Newton's rings.

Interferometers : Michelson's interferometer – applications, (i) determination of the wavelength of a monochromatic source of light, (ii) determination of the wavelength and separation D1 and D2 lines of sodium light, (iii) determination of a thickness of a mica sheet.

UNIT – III – DIFFRACTION: Fresnel's assumptions – zone plate – action of zone plate for an incident spherical wave front – differences between a zone plate and a convex lens –Fresnel type of diffraction – diffraction pattern due to a straight edge – positions of maximum and minimum intensities – Fraunhofer type of diffraction – Fraunhofer diffraction at a single slit (excluding calculus method) – plane diffraction grating– experiment to determine wavelengths.

UNIT – IV –POLARISATION: Polarizer and analyser– principal plane– polaroids and applications –double refraction – optic axis– Huygens's explanation of double refraction in uniaxial crystals – circularly and elliptically polarized light –quarter wave plate – half wave plate – production and detection of circularly and elliptically polarized lights- optical activity – optically active crystals– Fresnel's explanation – specific rotation – Laurent`s half shade polarimeter – experiment to determine specific rotatory power.

UNIT – V – SPECTROSCOPY: Infra-red spectroscopy- near infra-red and far infra-red – properties –origin of IR spectra – IR spectrophotometer – applications – Scattering of light – Raman effect –classical theory – quanum theory –Raman spectrometer– applications.

Text Books

1. Subramaniam. N&Brijlal, (2014). *Optics*, 25th edition,S.Chand &Co.
2. Gupta, S.L. Kumar, V. &.Sharma R.C (1997). *Elements of Spectroscopy*, 13th Edition, PragatiPrakashan, Meerut.
3. Aruldhass G. (2000). *Molecular Structure and Spectroscopy*,II edition.PHI Pvt Ltd, New Delhi.
4. Sasikumar, P.R. (2012). *Photonics*, PHIPvt Ltd, New Delhi.
5. Rajagopal, K. (2008). *Engineering Physics*, PHIPvt Ltd, New Delhi.
6. Rajendran, V. (2012).*Engineering Physics*, Tata McGraw Hill.

Reference Books

1. Agarwal B.S, (2011). *Optics*,KedernathRamnath Publishers, Meerut.
2. Sathyaprakash, (1990). Optics,VII edition, RatanPrakashanMandhir, New Delhi.
3. Banewell, C.N. (2006). Introduction to Molecular Spectroscopy,IVedition,TMH Publishing Co,New Delhi.
4. AjoyGhatak, (2009). Optics, 4thedition, PHIPvt Ltd, New Delhi.
5. Singh &Agarwal, (2002), Optics and Atomic Physics, 9thedition, PragatiPrakashan Meerut.
6. Halliday, D, ResnickR. and Walker, J. (2001). Fundamentals of Physics,6th edition, Willey, New York.
7. JenkinsA.Francis& White (2011). Fundamentals of Optics, 4th edition, McGraw Hill Inc., NewDelhi.

Web Resources

1. https://science.nasa.gov/ems/
2. https://www.youtube.com/watch?v=tL3rNc1G0qQ&list=RDCMUCzwo7UlGkb-8Pr6svxWo-LA&start_radio=1&t=2472
3. https://science.nasa.gov/ems/
4. https://www.youtube.com/watch?v=tL3rNc1G0qQ&list=RDCMUCzwo7UlGkb-8Pr6svxWo-LA&start_radio=1&t=2472
5. https://imagine.gsfc.nasa.gov/educators/gammaraybursts/imagine/index.html
6. http://www.thephysicsmill.com/2014/03/23/sky-blue-lord-rayleigh-sir-raman-scattering/
7. http://www.thephysicsmill.com/2014/03/23/sky-blue-lord-rayleigh-sir-raman-scattering/

Course Designers

1. Prof. M. Venkatachalam
2. Prof. R. Sribala
3. Dr. K. Gangadevi
4. Dr. R. A. Jeyaram

Thiagarajar College (Autonomous) :: Madurai – 625 009

Department of Physics

(For those joined B.Sc. Physics on or after June 2023)

PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH23NT21	PHYSICS FOR EVERYDAY LIFE	SEC	2	-	-	2

Year	Semester	Int. Marks	Ext. Marks	Total
I	SECOND	25	75	100

Preamble

Gain knowledge about physics principles used in day to day life with significant contributions made by the Indian scientist to physics.

Prerequisite

Basic knowledge on home and electrical appliances.

Course Outcome

#	Course Outcome	K Level	Expected Proficiency%	Expected Attainment%
CO1	Understand about working of mechanical objects.	K1,K2	85	80
CO2	Discuss about the defects of eye and its correction	K1	85	80
CO3	Understand the theory behind the working of Home appliances	K2	85	80
CO4	Know the importance of solar energy and its applications.	K2,K3	85	80
CO5	Know the significant contributions made by the Indian scientists to physics.	K2	85	80

Mapping of Course Outcome with Programme Outcomes

#	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	M	S	M	M
CO2	S	S	M	M	M	S
CO3	S	S	S	M	S	M

CO4	S	S	M	M	S	M
CO5	M	M	S	M	M	S

Mapping of Course Outcome with Programme Specific Outcomes

#	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	S	S	M
CO2	S	S	M	S	M
CO3	M	S	S	S	S
CO4	S	S	S	S	M
CO5	M	M	M	M	M

Blooms Taxonomy: Assessment Pattern

Bloom's category	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

PHYSICS FOR EVERYDAY LIFE

Unit I: MECHANICAL OBJECTS

Spring scales – bouncing balls –roller coasters – bicycles –rockets and space travel.

Unit II: OPTICAL INSTRUMENTS AND LASER

vision corrective lenses – polaroid glasses – UV protective glass – polaroid camera – colour photography – holography and laser

Unit III: PHYSICS OF HOME APPLIANCES:

bulb – fan – hair drier – television – air conditioners – microwave ovens – vacuum cleaners

Unit IV: SOLAR ENERGY

Solar constant – General applications of solar energy – Solar water heaters – Solar Photo – voltaic cells – General applications of solar cells.

Unit V: INDIAN PHYSICIST AND THEIR CONTRIBUTIONS

C.V.Raman, HomiJehangirBhabha, Vikram Sarabhai, Subrahmanyan Chandrasekhar, VenkatramanRamakrishnan, Dr. APJ Abdul Kalam and their contributions to science and technology.

Text Books

1. UmmeAmmara, (2019).*The Physics in our Daily Lives,* Gugucool Publishing, Hyderabad.
2. Walter Lawin, (2011).*For the love of physics*, Free Press, New York.

.

Reference Books

1. Jose Robin G. &Ubald Raj A. (2013). *Maintenance of Electrical Equipments* First Edition, Indira Publication Marthandam - July 2013.
2. Theraja B.L. &Theraja, A.K. (2005). *A Text Book of Electrical Technology*, S. Chand &Company Ltd., New Delhi, India,

Web Resources

1. https://en.wikipedia.org/wiki/Home_appliance
2. https://www.electricveda.com/book/electric-appliances

Course Designers

1. Dr.D.Yamini
2. Dr.R.Sangeetha
3. Dr.R.A.Jeyaram

Thiagarajar College (Autonomous):: Madurai – 625 009

Department of Physics

(For those joined B.Sc. Physics on or after June 2023)

PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH23ST21	**ENERGY PHYSICS**	SEC I	2	-	-	2

Year	Semester	Int. Marks	Ext. Marks	Total
I	Second	25	75	100

Preamble

- This paper enables the students to understand the feature of various available renewable energy sources and also helps them to gain theoretical knowledge of it.
- This paper provides an understanding of the present energy crisis and various energy conversion systems.
- It also creates awareness about the usage of alternative evergreen sources.

Course Outcomes

On the completion of the course the student will be able to

#	Course Outcome	K level	Expected Proficiency %	Expected Attainment %
CO1	Understand of conventional and non-conventional energy sources.	K1,K2	85	80
CO2	A good understand of solar energy in detail and its applications.	K2	85	80
CO3	Gain knowledge on wind energy and its energy conversion systems.	K2	85	80
CO4	Develop capability to do basic design of bio gas plant.	K3	85	80
CO5	Understand the applications of different energy storage devices, batteries including hydrogen storage etc.	K3	85	80

Mapping of Course Outcomes with Programme Outcomes

#	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	M	M	M	M
CO2	S	S	L	L	L	L
CO3	S	L	M	M	M	M
CO4	S	L	L	L	L	L
CO5	S	L	M	M	M	M

Mapping of Course Outcomes with Programme Specific Outcomes

#	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	M
CO2	S	S	L	L	M
CO3	S	L	S	L	M
CO4	S	M	M	M	L
CO5	S	L	L	M	M

Blooms taxonomy: Assessment Pattern

Bloom's category	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Syllabus: ENERGY PHYSICS

Unit I ENERGY SOURCES: Energy consumption as a measure of prosperity – World energy future – conventional energy sources – renewable energy sources – comparison – Merits and Demerits.

Unit II SOLAR ENERGY: Solar energy introduction – solar constant – solar radiation measurements – solar water heater – solar cells – solar cooker - solar greenhouse – types of greenhouse gasses.

Unit III WIND ENERGY: Introduction – nature of the wind – basic principle of wind energy conversion – basic components of Wind Energy Conversion Systems (WECS) – advantages and disadvantages of WECS – applications.

Unit IV BIOMASS ENERGY: Biomass introduction – classification – biomass conversion technologies - fermentation - biogas generation – classification of biogas plants - advantages & disadvantages.

Unit V ENERGY STORAGE DEVICES: Importance of energy storage - batteries - leads acid battery - nickel- cadmium battery - fuel cells - applications of fuel cells - hydrogen storage.

Text Books

1. Rai, G.D. (2009). *Non-Conventional Sources of Energy*, 4thEdn.Khanna Publishers,

   Unit 1: sec 1.2, 1.3, 1.4.1, 1.4.2, 1.4.3, 1.5
   Unit 2: sec 2.1, 2.2, 2.5, 5.2, 5.6, 5.11, 5.12
   Unit 3: sec 6.1, 6.2, 6.5, 6.7, 6.13
   Unit 4: sec 7.1, 7.2, 7.4, 7.6, 7.25
   Unit 5: sec 10.3, 10.2.1, 10.2.2, 10.2.3, 10.2.5, 11.3

Reference Books

1. S P Sukhstme, J K Nayak, Solar Energy, Principles of Thermal Collection and Storage, McGrawHill, 2008, 3rd Edn.
2. D P Kothari, K P Singal, RakeshRajan, PHI Learning Pvt Ltd, 2011, 2ndEdn.
3. John Twidell& Tony Weir, (2005).*Renewable Energy Resources*,2nd Edn Taylor & Francis.
4. AbbasiS.A. and NasemaAbbasi, (2008).*Renewable Energy sources and their environmental impact*, PHI Learning Pvt. Ltd, India.
5. Agarwal, M. P. (1982).*Solar Energy*, S. Chand & Co. Ltd., New Delhi,
6. Jain, H. C. (1986). *Non-Conventional Sources of Energy*, Sterling Publishers.

Web Resources

1. https://mnre.gov.in/the-ministry/what-does-the-ministry-do/
2. https://nptel.ac.in/courses/121106014
3. https://www.youtube.com/watch?v=Zgp86PVXXuQ
4. https://www.youtube.com/watch?v=GRwJqD4StEU
5. http://www.oas.org/dsd/publications/unit/oea37e/ch18.html

Course Designers

1. DR. S. RAJAKARTHIHAN&
2. DR.D.SARAVANAKKUMAR

Thiagarajar College (Autonomous) :: Madurai – 625 009

Department of Physics

(For those joined B.Sc. Physics on or after June 2023)

PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH23CL11	**Practical – 1**	Core	-	-	2	2

Year	Semester	Int. Marks	Ext. Marks	Total
First	First	25	75	100

Preamble

- This paper enables the students to understand the feature of various properties of matter
- This paper provides hands on training through the experiments in properties of matter.

Prerequisite

Modulus of elasticity, surface tension, viscosity, acceleration due to gravity.

Course Outcome

On the successful completion of the course the student will be able to

#	Course Outcome	K Level	Expected Proficiency%	Expected Attainment%
CO1	Remember various Physics concepts to understand Properties of Matter.	K1	80	75
CO2	Understand and set up experimentation to verify theories.	K2	80	75
CO3	Apply the observations and make meaningful conclusion	K3	80	75

CO4	Analyze and correlate the results to the applications of different system involving materials.	K3	80	75
CO5	Checking to do error analysis based on calculation	K3	80	75

Mapping of Course Outcome with Programme Outcomes

#	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	-	M	S	L
CO2	M	S	M	S	S	L
CO3	M	L	M	S	S	L
CO4	S	S	L	S	S	M
CO5	L	M	S	M	L	S

Mapping of Course Outcome with Programme Specific Outcomes

#	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	M
CO2	S	S	L	L	M
CO3	S	L	S	L	M
CO4	S	M	M	M	L
CO5	S	L	L	M	M

CORE PRACTICAL – I : LIST OF EXPERIMENTS

1. Determination of rigidity modulus without mass using Torsional pendulum.
2. Determination of rigidity modulus with masses using Torsional pendulum.
3. Determination of moment of inertia of an irregular body.
4. Verification of parallel axes theorem on moment of inertia.
5. Verification of perpendicular axes theorem on moment of inertia.
6. Determination of moment of inertia and g using Bifilar pendulum.
7. Determination of Young's modulus by stretching of wire with known masses.
8. Verification of Hook's law by stretching of wire method.
9. Determination of Young's modulus by uniform bending – load depression graph.
10. Determination of Young's modulus by non-uniform bending – scale & telescope.
11. Determination of Young's modulusby cantilever – load depression graph.
12. Determination of Young's modulus by cantilever – oscillation method
13. Determination of Young's modulus by Koenig's method – (or unknown load)
14. Determination of rigidity modulus by static torsion.
15. Determination of Y, n and K by Searle's double bar method.

16. Determination of surface tension & interfacial surface tension by drop weight method.
17. Determination of co-efficient of viscosity by Stokes' method – terminal velocity.
18. Determination of critical pressure for streamline flow.
19. Determination of Poisson's ratio of rubber tube.
20. Determination of viscosity by Poiseullie's flow method.
21. Determination radius of capillary tube by mercury pellet method.
22. Determination of g using compound pendulum.

Course Designers

1. Dr. S. RAJAKARTHIHAN
2. Dr. J. SUVETHA RANI
3. Mr. S. ALAGURAJA
4. Dr. K. GANGADEVI

Thiagarajar College (Autonomous), Madurai – 625 009

Department of Physics

(For those joined B.Sc. Physics on or after June 2023)

PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH23CL21	**Core Practical – 2**	Core	-	-	2	2

Year	Semester	Int. Marks	Ext. Marks	Total
First	Second	25	75	100

Preamble

- This paper enables the students to understand the feature of heat and sound
- This paper provides hands on training through the experiments in heat and sound

Prerequisite

Specific heat capacity, thermal conductivity, velocity of sound, transverse vibration.

Course Outcome

On the successful completion of the course the student will be able to

#	Course Outcome	K Level	Expected Proficiency%	Expected Attainment%
CO1	Remember various Physics concepts of heat and sound.	K1	80	75
CO2	Understand and set up experimentation to verify theories.	K2	80	75
CO3	Apply the observations and make meaningful conclusion.	K3	80	75
CO4	Analyze and correlate the results of the applications.	K3	80	75
CO5	Checking to do error analysis based on calculation.	K3	80	75

Mapping of Course Outcome with Programme Outcomes

#	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	-	M	S	L
CO2	M	S	M	S	S	L
CO3	M	L	M	S	S	L
CO4	S	S	L	S	S	M
CO5	L	M	S	M	L	S

Mapping of Course Outcome with Programme Specific Outcomes

#	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	M
CO2	S	S	L	L	M
CO3	S	L	S	L	M
CO4	S	M	M	M	L
CO5	S	L	L	M	M

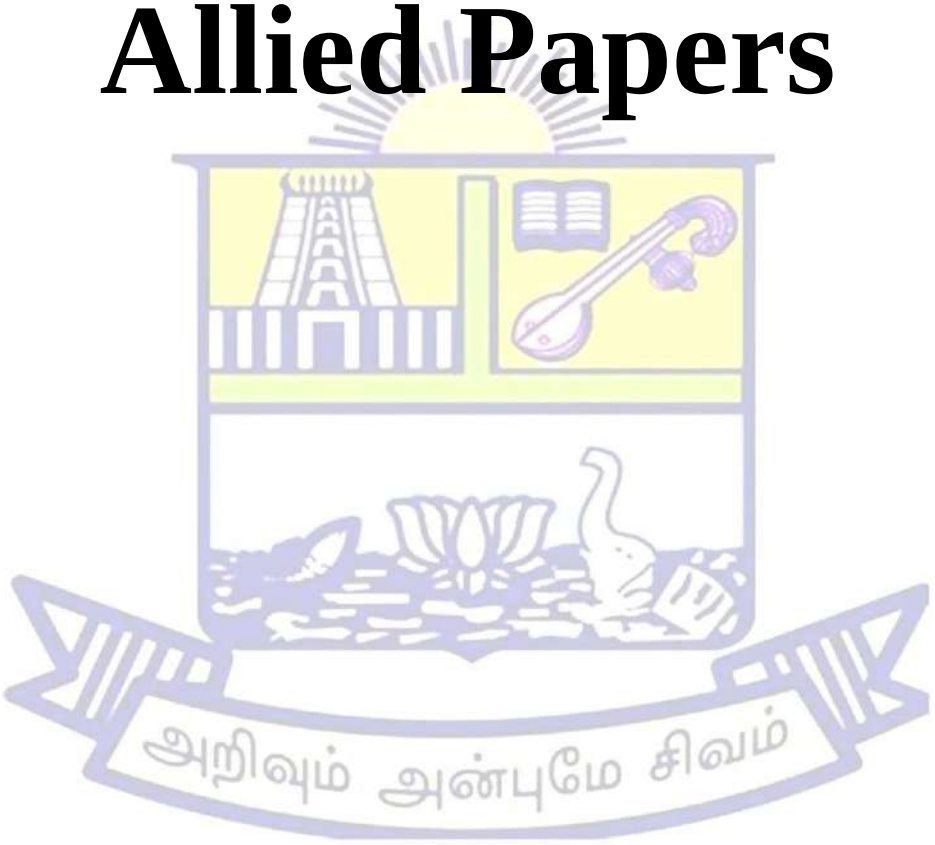
CORE PRACTICAL – II : LIST OF EXPERIMENTS

1. Determination of specific heat by cooling – graphical method.
2. Determination of thermal conductivity of good conductor by Searle's method.
3. Determination of thermal conductivity of bad conductor by Lee's disc method.
4. Determination of thermal conductivity of bad conductor by Charlaton's method.
5. Determination of specific heat capacity of solid.
6. Determination of specific heat of liquid by Joule's electrical heating method (applying radiation correction by Barton's correction/graphical method),
7. Determination of Latent heat of a vaporization of a liquid.
8. Determination of Stefan's constant for Black body radiation.
9. Verification of Stefan's-Boltzmans law.
10. Determination of thermal conductivity of rubber tube.
11. Helmholtz resonator.
12. Velocity of sound through a wire using Sonometer.
13. Determination of velocity of sound using Kunds tube.
14. Determination of frequency of an electrically maintained tuning fork
15. To verify the laws of transverse vibration using sonometer.
16. To verify the laws of transverse vibration using Melde's apparatus.
17. To compare the mass per unit length of two strings using Melde's apparatus.
18. Frequency of AC by using sonometer.

Course Designers

1. Dr. S. RAJAKARTHIHAN
2. Dr. J. SUVETHA RANI
3. Mr. S. ALAGURAJA
4. Dr. K. GANGADEVI

Allied Papers



Thiagarajar College (Autonomous) :: Madurai – 625 009

Department of Physics

(For those joined B.Sc. Physics on or after June 2023)

PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH23GT11C	ALLIED PHYSICS – I	ALLIED PAPER	3	2	-	3

Year	Semester	Int. Marks	Ext.Marks	Total
I	FIRST	25	75	100

Preamble

- Understand the theory behind elasticity, viscosity and surface tension**.**
- Know the laws of thermodynamics.
- Learn the working of basic logic gates and their use in Digital India.

Prerequisite

Simple harmonic oscillations, modulus of elasticity, ultrasonics, Carnot Engine, entropy, e.m.f., logic gates.

Course Outcome

#	Course Outcome	K Level	Expected Proficiency %	Expected Attainment %
CO1	Explain types of motion and extend their knowledge in the study of various dynamic motions analyze and demonstrate mathematically.	K1	80	75
CO2	Explain their knowledge of understanding about materials and their behaviors and apply it to various situations in laboratory and real life. Connect droplet theory with Corona transmission.	K1,K2	80	75
CO3	Comprehend basic concept of thermodynamics, concept of entropy and associated theorems and able to interpret the process of flow temperature physics in the	K2	80	75

Mapping of Course Outcome with Programme Outcomes				
	background of growth of this technology.			
CO4	Correlate the connection between electric field and magnetic field and analyze them mathematically verify circuits and apply the concepts to construct circuits and study them.	K3	80	75
CO5	Interpret the real life solutions using AND, OR, NOT basic logic gates and intend their ideas to universal building blocks. Acquire information about various Govt. programs/ institutions in this field.	K3	80	75

#	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	S	M	M	S
CO2	M	S	S	M	M	S
CO3	S	M	M	M	M	S
CO4	S	S	S	S	S	S
CO5	S	S	M	S	S	S

Mapping of Course Outcome with Programme Specific Outcomes

#	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	S	M	M	S
CO2	S	S	S	M	S
CO3	S	S	M	S	S
CO4	M	S	M	M	S
CO5	S	S	M	M	S

Blooms Taxonomy: Assessment Pattern

Bloom's category	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

ALLIED PHYSICS – I

Unit I: WAVES, OSCILLATIONS AND ULTRASONICS

Simple harmonic motion (SHM) – composition of two SHMs at right angles (periods in the ratio 1:1)– laws of transverse vibrations of strings – determination of AC frequency

using sonometer (steel and brass wires) – ultrasound – production –piezoelectric method – application of ultrasonics: medical field.

Unit II: PROPERTIES OF MATTER

Elasticity: elastic constants – bending of beam – theory of non- uniform bending – determination of Young's modulus by non-uniform bending – energy stored in a stretched wire – torsion of a wire – determination of rigidity modulus by torsional pendulum.

Viscosity: streamline and turbulent motion – critical velocity –coefficient of viscosity – Poiseuille's formula – comparison of viscosities – burette method,

Surface tension: definition – molecular theory – droplets formation–shape, size and lifetime – COVID transmission through droplets, saliva – drop weight method – interfacial surface tension.

Unit III: HEAT AND THERMODYNAMICS

Joule-Kelvin effect – Joule-Thomson porous plug experiment – theory – temperature of inversion – liquefaction of Oxygen– thermodynamic system – thermodynamic equilibrium– laws of thermodynamics – heat engine – Carnot's cycle – efficiency – entropy – change of entropy in reversible and irreversible process.

Unit IV: ELECTRICITY AND MAGNETISM

Potentiometer – principle – measurement of thermo emf using potentiometer –magnetic field due to a current carrying conductor – Biot-Savart's law – field along the axis of the coil carrying current – peak, average and RMS values of ac current and voltage – power factor and current values in an AC circuit – types of switches in household and factories– Smart wifi switches- fuses and circuit breakers in houses.

Unit V: DIGITAL ELECTRONICS AND DIGITAL INDIA

logic gates, OR, AND, NOT, NAND, NOR , EXOR logic gates – universal building blocks – Boolean algebra – De Morgan's theorem –verification – overview of Government initiatives: software technological parks under MeitY, NIELIT-semiconductor laboratories under Dept. of Space – an introduction to Digital India

Text Books

1. R.Murugesan (2001),*Allied Physics*, S. Chand & Co, New Delhi.
2. Brijlal and N. Subramanyam (1994). *Waves and Oscillations*,Vikas Publishing House, New Delhi.
3. Brijlal and N. Subramaniam (1994).*Properties of Matter*, S.Chand& Co.,NewDelhi.
4. RajamJ.B. and AroraC.L. (1976) *Heat and Thermodynamics* (8th edition), S.Chand&Co.,New Delhi.
5. MurugesanR.(2005). *Optics and Spectroscopy*,S.Chand&Co,New Delhi.

6. Subramaniyam, *Applied Electronics* 2nd Edn., National Publishing Co.,Chennai.

Reference Books

1. Resnick, Halliday and Walker (2018).*Fundamentals of Physics* (11th edition),John Willey and Sons, Asia Pvt.Ltd., Singapore.
2. Khannaand, V.R.BediR.S.(1998), *Textbook of Sound* 1st Edn. Kedharnaath Publish & Co, Meerut.
3. KhareN.S.andSrivastavaS.S.(1983), *Electricity and Magnetism* 10thEdn.,Atma Ram & Sons, New Delhi.
4. KhannaD.R.and Gulati, H.R. (1979). *Optics*,S. Chand &Co.Ltd.,New Delhi.
5. MethaV.K.(2004).*Principles of electronics* 6thEdn. S.Chand and company.

Web Resources

1. https://youtu.be/M_5KYncYNyc
2. https://youtu.be/ljJLJgIvaHY
3. https://youtu.be/7mGqd9HQ_AU
4. https://youtu.be/h5jOAw57OXM
5. https://learningtechnologyofficial.com/category/fluid-mechanics-lab/
6. http://hyperphysics.phy-astr.gsu.edu/hbase/permot2.html
7. https://www.youtube.com/watch?v=gT8Nth9NWPM
8. https://www.youtube.com/watch?v=9mXOMzUruMQ&t=1s
9. https://www.youtube.com/watch?v=m4u-SuaSu1s&t=3s
10. https://www.biolinscientific.com/blog/what-are-surfactants-and-how-do-they-work

Course Designers

1. Mr.S.Alaguraja
2. Dr.D.Yamini
3. Dr.D.Saravanakkumar
4. Dr.R.Sangeetha

Thiagarajar College (Autonomous) :: Madurai – 625 009

Department of Physics

(For those joined B.Sc. Physics on or after June 2023)

PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH23GL11C	ALLIED PRACTICALS – I	ALLIED PRACTICAL	-	-		

Year	Semester	Int. Marks	Ext.Marks	Total
I	FIRST	25	75	100

Preamble

Realize theoretical concepts through carrying out experiments.

Apply various physics concepts to understand Properties of Matter and waves, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results.

Prerequisite

Modulus of elasticity, Surface tension, viscosity, transverse vibration, potentiometer, logic gates.

Course Outcome

#	Course Outcome	K Level	Expected Proficiency%	Expected Attainment%
CO1	Identify the link between theory and practical	K1	80	75
CO2	Develop the skill of performing experiments accurately	K2	80	75
CO3	Report observations and analyses in a scientific manner	K2	80	75
CO4	Appreciate the applications of logic IC's.	K3	80	75
CO5	Analyze observations and make meaningful conclusions	K3	80	75

Mapping of Course Outcome with Programme Outcomes

#	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	S	S	L	M
CO2	M	S	M	S	M	M
CO3	S	M	S	S	L	M
CO4	S	L	M	S	M	S
CO5	S	M	S	S	L	M

Mapping of Course Outcome with Programme Specific Outcomes

#	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	L	L
CO2	S	L	L	M	L
CO3	S	S	M	M	L
CO4	M	M	L	L	S
CO5	S	L	L	S	M

LIST OF EXPERIMENTS (Any Seven Only)

1. Young's modulus by non-uniform bending using pin and microscope
2. Young's modulus by non-uniform bending using optic lever, scale and telescope
3. Rigidity modulus by static torsion method.
4. Rigidity modulus by torsional oscillations without mass
2. Surface tension and interfacial Surface tension – drop weight method
3. Comparison of viscosities of two liquids – burette method
4. Specific heat capacity of a liquid – half time correction
5. Verification of laws of transverse vibrations using sonometer
6. Calibration of low range voltmeter using potentiometer
7. Determination of thermo emf using potentiometer
8. Verification of truth tables of basic logic gates using ICs
9. Verification of De Morgan's theorems using logic gate ICs.
10. Use of NAND as universal building block**.**

Thiagarajar College (Autonomous):: Madurai – 625 009

Department of Physics

(For those joined B.Sc. Physics on or after June 2023)

PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH23GT21C	**ALLIED PHYSICS –II**	ALLIED PAPER	3	-	-	3

Year	Semester	Int. Marks	Ext.Marks	Total
I	Second	25	75	100

Preamble

- Know the physics of optical phenomena like interference, diffraction and polarisation.
- Learn the various types atomic model with atomic theory and effects.
- Understand the basics of nuclear forces, half-life period, model and reactors
- Understand the basics of relativity and gravitational waves.
- Understand the basics of semiconductor and diodes also its applications.

Prerequisite

Interference, diffraction, atom model, nuclear fission and fusion, relativity, semiconductor.

Course Outcome

On the completion of the course the student will be able to

#	Course Outcome	K Level	Expected Proficiency%	Expected Attainment%
CO1	Explain the concepts of interference diffraction using principles of superposition of waves and rephrase the concept of polarization based on wave patterns.	K1	80	75
CO2	Outline the basic foundation of different atom models and various experiments establishing quantum concepts.	K2	80	75
CO3	Summarize the properties of nuclei, nuclear forces and nuclear models. Solve problems on	K3	80	75

	delay rate half-life and mean-life. Interpret nuclear processes like fission and fusion. Understand the importance of nuclear energy, safety measures carried and get our Govt. agencies like DAE guiding the country in the nuclear field.			
CO4	Describe the basic concepts of relativity like equivalence principle, inertial frames and Lorentz transformation. Extend their knowledge on concepts of relativity and vice versa. Relate this with current research also the projects of National and International level and opportunities.	K3	80	75
CO5	Summarize the working of semiconductor devices like junction diode, Zener diode, transistors and practical devices we daily use like EV charging stations.	K3	80	75

Mapping of Course Outcome with Programme Outcomes

#	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	S	S	S	S	S
CO2	M	S	S	S	S	S
CO3	M	S	S	S	S	M
CO4	S	S	S	S	S	S
CO5	M	S	S	S	S	S

Mapping of Course Outcome with Programme Specific Outcomes

#	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	S	S	S
CO2	S	S	S	M	S
CO3	S	S	S	S	S
CO4	S	M	S	S	S
CO5	S	S	S	S	S

Blooms Taxonomy: Assessment Pattern

Bloom's category	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

ALLIED PHYICS – II

Unit I OPTICS:
Interference – interference in thin films –colors of thin films – air wedge – determination of diameter of a thin wire by air wedge – diffraction – diffraction of light vs sound – normal incidence – experimental determination of wavelength using diffraction grating (no theory) – polarization – polarization by double refraction – Brewster's law – optical activity – application in sugar industries.

Unit II ATOMIC PHYSICS:
Atom models – Bohr atom model – mass number – atomic number – nucleons – vector atom model – various quantum numbers – Pauli's exclusion principle – electronic configuration – periodic classification of elements – Bohr magneton – Stark effect – Zeeman effect (elementary ideas only).

Unit III NUCLEAR PHYSICS:
Nuclear models – liquid drop model– nuclear energy – mass defect – binding energy – radioactivity – uses – half life – mean life - radio isotopes and uses –controlled and uncontrolled chain reaction – nuclear fission – energy released in fission atom bomb – nuclear reactor – breeder reactor – importance of commissioning PFBR in our country – heavy water disposal, safety of reactors: seismic and floods –introduction to DAE, IAEA – nuclear fusion – thermonuclear reactions – differences between fission and fusion.

Unit IV INTRODUCTION TO RELATIVITY AND GRAVITATIONAL WAVES:
Frame of reference – postulates of special theory of relativity – Galilean transformation equations – Lorentz transformation equations – derivation – length contraction – time dilation – twin paradox – mass-energy equivalence –introduction on gravitational waves, LIGO, ICTS opportunities at International Centre for Theoretical Sciences.

Unit V SEMICONDUCTOR PHYSICS:
p-n junction diode – forward and reverse biasing – characteristic of diode – zener diode – characteristic of zener diode – voltage regulator – full wave bridge rectifier – construction and working – advantages (no mathematical treatment) –introduction to e-vehicles and EV charging stations.

Text Books

1. MurugesanR.(2005),*Allied Physics*, S.Chand& Co, New Delhi.
2. ThangarajK.andJayaramanD. (2004),*Allied Physics*, Popular Book Depot, Chennai.
3. Brijlal and SubramanyamN.(2002), *Textbook of Optics*, S.Chand& Co, New Delhi.
4. MurugesanR.(2005), *Modern Physics*, S.Chand& Co, New Delhi.
5. SubramaniyamA.*Applied Electronics*, 2nd Edn., National Publishing Co., Chennai.

Reference Books

1. ResnickHalliday and Walker (2018), *Fundamentals of Physics*, 11thEdn., John Willey and Sons, Asia Pvt.Ltd., Singapore.
2. KhannaD.R.andGulatiH.R. (1979).*Optics*,S.Chand& Co. Ltd., New Delhi.
3. BeiserA.(1997), *Concepts of Modern Physics*,TataMcGraw Hill Publication, New Delhi.
4. Thomas L. Floyd (2017), *Digital Fundamentals*, 11thEdn., Universal Book Stall, NewDelhi.
5. MethaV.K. (2004), *Principles of electronics*, 6thEdn. ,S.Chand and Company, New Delhi.

Web Resources

1. https://www.berkshire.com/learning-center/delta-p-facemask/https://www.youtube.com/watch?v=QrhxU47gtj4https://www.youtube.com/watch?time_continue=318&v=D38BjgUdL5U&feature=emb_logo
2. https://www.youtube.com/watch?v=JrRrp5F-Qu4
3. https://www.validyne.com/blog/leak-test-using-pressure-transducers/
4. https://www.atoptics.co.uk/atoptics/blsky.htm
5. https://www.metoffice.gov.uk/weather/learn-about/weather/optical-effects

Course Designers

1. Mr.S.Alaguraja
2. Dr.D.Yamini
3. Dr.D. Saravanakkumar
4. Dr.R.Sangeetha

Thiagarajar College (Autonomous) :: Madurai – 625 009

Department of Physics

(For those joined B.Sc. Physics on or after June 2023)

PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH23GL21C	ALLIED PRACTICALS – II	ALLIED PRACTICAL	-	-	2	2

Year	Semester	Int. Marks	Ext.Marks	Total
FIRST	SECOND	25	75	100

Preamble

Apply various Physics concepts to understand concepts of Light, electricity and magnetism and waves, set up experimentation to verify theories, quantify and analyse, able to do error analysis and correlate results.

Prerequisite

Radius of curvature, refractive index, thermal conductivity, Zener diode, logic gates.

Course Outcome

#	Course Outcome	K level	Expected Proficiency%	Expected Attainment%
CO1	Identify the link between theory and practical	K1	80	75
CO2	Develop the skill of performing experiments accurately	K1	80	75
CO3	Report observations and analyses in a scientific manner	K2	80	75
CO4	Appreciate the applications of diodes and transistors	K2	80	75
CO5	Analyze observations and make meaningful conclusions	K3	80	75

Mapping of Course Outcome with Programme Specific Outcomes

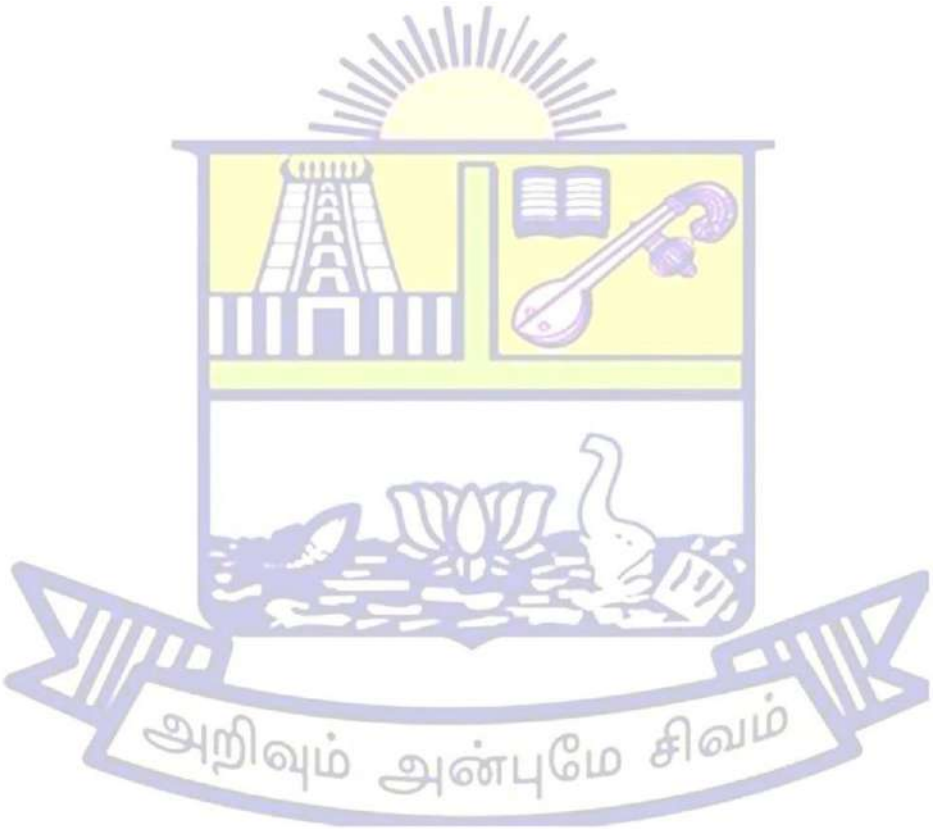
#	PO1	PO2	PO3	PO4	PO5	PO6
CO1	S	M	S	S	L	M
CO2	M	S	M	S	M	M
CO3	S	M	S	S	L	M
CO4	S	L	M	S	M	S
CO5	S	M	S	S	L	M

Mapping of Course Outcome with Programme Specific Outcomes

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	L	L
CO2	S	L	L	M	L
CO3	S	S	M	M	L
CO4	M	M	L	L	S
CO5	S	L	L	M	M

LIST OF EXPERIMENTS (Any Eight)

1. Radius of curvature of lens by forming Newton's rings
2. Thickness of a wire using air wedge
3. Wavelength of mercury lines using spectrometer and grating
4. Refractive index of material of the lens by minimum deviation
5. Refractive index of liquid using liquid prism
6. Determination of AC frequency using sonometer
7. Specific resistance of a wire using PO box
8. Thermal conductivity of poor conductor using Lee's disc
9. Determination of figure of merit table galvanometer
10. Determination of Earth's magnetic field using field along the axis of a coil
11. Characteristics of Zener diode
12. Construction of Zener/IC regulated power supply
13. Construction of AND, OR, NOT gates using diodes and transistor
14. NOR gate as a universal building block


அறிவும் அன்புமே சிவம்