Thiagarajar College

(An Autonomous Institution Affiliated to Madurai Kamaraj University)
Re-Accredited with 'A' Grade by NAAC

Thirty Eighth Academic Council Meeting

Department of Physics

Dr. Rm. Murugappan
Dean – Curriculum Development

B.Sc. Physics

Programme Code : UPH

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A' Grade by NAAC)

Curriculum structure for

B.Sc., CS, IT & BCA BBA & B.Com

(For those who joined in 2019 and after)

Catergory	Course	No.of Courses /paper	Credit Distribution	Hrs/ Week	Total Credits
Part I	Tamil	2	3	-	06
Part II	English	2	3	-	06
		Sub Total			**12**
Part III	Core	-	-	-	84
	Elective –Main	2	5	-	10
	Elective – Generic	2+2	5	-	20
		Sub Total			**114**
Part IV	**AECC** I &II Sem	I sem EVS II Sem .Prof.Skill Development	2	4	04
	NME III & V Sem Horizontal Migration **SEC** IV & VI Sem Vertical Migration	2 2	2	8	08
	Value Education V Sem	1	1	2	**01**
		Sub Total		**14**	**13**
	Total				**139**
Part V	**NCC (Army &Navy)/ PE/ NSS / Rotaract/ Quality Circle/ Library/ SSL/ Nature Club/Value Education/ YRC/WSC**				**01**
	Grand Total				**140**
	Self-Study Paper (Optional)- -V Sem			**05**	**145**

AECC – Ability Enhancement Compulsory Course

SEC – Skill Enhancement Course

NME – Non Major Elective

For Choice based credit system (CBCS)

- For NME every department offers two papers (one in each at III &V semester)
- For SEC every department offer three papers for each course (Sem IV & VI)
- For Major elective there may be an option for choice.

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A' Grade by NAAC)

Curriculum structure for

BA Tamil, English & Economics

B.Sc., Maths, Physics, Chemistry, Botany, Biotechnology Microbiology and Psychology

(For those who joined in 2019 and after)

Catergory	Course	No.of Courses /paper	Credit Distribution	Hrs/ Week	Total Credits
Part I	Tamil	4	3	12+12	12
Part II	English	4	3	12+12	12
		Sub Total		**48**	**24**
Part III	Core			72 +12	72
	Elect –Main	2	5	10	10
	Elect – Generic	2+2	5	24	20
		Sub Total		**118**	**102**
Part IV	**AECC** I &II Sem	I sem EVS II Sem .Prof.Skill Development	2	4	04
	NME III & V Sem Horizontal Migration **SEC** IV & VI Sem Vertical Migration	2 2	2	8	08
	Value Education V Sem	1	1	2	**1**
		Sub Total		**14**	**13**
	Total				**139**
Part V	**NCC (Army &Navy)/ PE/ NSS / Rotaract/ Quality/WSC Circle/ Library/ SSL/ Nature Club/Value Education/ YRC**				**1**
	Grand Total				**140**
	Self-Study Paper (Optional)- -V Sem			**05**	**145**

AECC – Ability Enhancement Compulsory Course

SEC – Skill Enhancement Course

NME – Non Major Elective

For Choice based credit system (CBCS)

- For NME every department offers two papers (one in each at III &V semester)
- For SEC every department offer three papers for each course (Sem IV & VI)
- For Major elective there may be an option for choice.

Programme outcome-PO (Aligned with Graduate Attributes)- Bachelor of Science (B.Sc.,)

Scientific Knowledge and Critical Thinking

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

Problem Solving

Identify and analyze 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.,

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 discipline

Life-Long 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.

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.

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, intellectual skills.

Department of Physics

"LIGHT"

(Learn with focus;**I**nnovate for a cause; be **G**rateful; be **H**umane; **T**ransform dreams intoreality)

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 studentsto promote innovation* • *To bridge the gap between curriculum based learning and career readiness/employabilityof physics graduates* • *To create a conscientious awareness among students about issues pertaining to welfare of society and environment*

B.Sc. Physics
Programme Educational Objectives

PEO1	A successful career in academia, government, industry, corporates or as an 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 presenting a brief lecture on a specific topic in physics or writing scientific reports, projects, dissertation 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

ProgrammeSpecific Outcomes

At the end of the programme, 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 analyses problems in physics identifying key concepts and principles to solve them
PSO5	Plan and execute an experiment through careful observations, precise measurements, analyses, 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 (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE : UPH
Semester – I

Course	Code No	Subject	Contact Hrs / Week	Credits	Total No of Hrs Allotted/ Semester	Max Marks CA	Max Marks SE	Total
Part I Tamil	U19TM11	IkkalaIlakkiyam	6	3	90	25	75	100
Part II English	U19EN12	Communicative English - I	6	3	90	25	75	100
Core	UPH19C11	Properties of Matter	4	3	60	25	75	100
Core	UPH19C12	Heat and Thermodynamics	4	3	60	25	75	100
LAB	UPH19CL21	Major Practical-I	2	-	30	-	-	-
Allied	UMA19GE11P	Allied Mathematics - I	6	5	90	25	75	100
AECC	U19ES11	Environmental Science	2	2	30	15	35	50
TOTAL			**30**	**19**	**450**	**140**	**410**	**550**

Semester – II

Course	Code No	Subject	Contact Hrs / Week	Credits	Total No of Hrs Allotted/ Semester	Max Marks CA	Max Marks SE	Total
Part I Tamil	U19TM21	Tamil / Other Language	6	3	90	25	75	100
Part II English	U19EN22	English	6	3	90	25	75	100
Core	UPH19C21	Mechanics	4	3	60	25	75	100
Core	UPH19C22	Optics	4	3	60	25	75	100
LAB	UPH19CL21	Major Practical-I	2	3	30	40	60	100
Allied	UMA19GE21P	Ancillary Mathematics-II	6	5	90	25	75	100
AECC	UPH19AE21	Data analysis and interpretation	2	2	30	15	35	50
TOTAL			**30**	**22**	**450**	**180**	**470**	**650**

Semester – III

Course	Code No	Subject		Contact Hrs / Week	Credits	Total No of Hrs Allotted	Max Marks CA	Max Marks SE	Total
Part I Tamil	U19TM31	Tamil / Other Language		6	3	90	25	75	100
Part II English	U19EN32	English		6	3	90	25	75	100
Core	UPH19C31	Electricity & Magnetism		4	4	60	25	75	100
Core	UPH19C32	Modern Optics		4	4	60	25	75	100
LAB	UPH19CL41	Major Practical-II		2	-	30	-	-	-
Allied	UCH19GE31P UCH19GL41P	Allied – I (Chemistry)	Theory	4	4	60	25	75	100
			Practical	-	2	30	-	-	-
Non Major Elective I	UPH19NE31	Solar energy		2	2	30	15	35	50
TOTAL				**30**	**20**	**450**	**140**	**420**	**550**

Semester – IV

Course	Code No	Subject		Contact Hrs / Week	Credits	Total No of Hrs Allotted	Max Marks CA	Max Marks SE	Total
Part I Tamil	U19TM41	Tamil / Other Language		6	3	90	25	75	100
Part II English	U19EN42	English		6	3	90	25	75	100
Core	UPH19C41	Materials Science		4	4	60	25	75	100
Core	UPH19C42	Fundamentals of Electronics		4	4	60	25	75	100
LAB	UPH19CL41	Major Practical-II		2	3	30	40	60	100
Allied	UCH19GE41P UCH19GL41P	Allied – II (Chemistry)	Theory	4	4	60	25	75	100
			Practical	2	2	30	40	60	100
SEC 1	UPH19SE41 A/B/C	Introduction to nanophysics-I/ Medical physics-I/Physics in everyday life		2	2	30	15	35	50
TOTAL				**30**	**25**	**450**	**220**	**530**	**750**

Semester – V

Course	Code No	Subject	Contact Hrs / Week	Credits	Total No of Hrs Allotted	Max Marks CA	Max Marks SE	Total
Core	UPH19C51	Elementary Solid State Physics	6	6	90	25	75	100
Core	UPH19C52	Analog Electronics	6	6	90	25	75	100
Core	UPH19C53	Modern Physics	6	6	90	25	75	100
Elective	UPH19CE51 A/B/C	Numerical Methods with Programming in C /Mathematical Physics/Introduction to Microprocessor	4	4	60	25	75	100
Non Major Elective II	UPH19NE51	Non-conventional energy	2	2	30	15	35	50
LAB	UPH19CL61	Major Practical-III (General)	2	-	30	-	-	-
LAB	UPH19CL62	Major Practical-IV (Electronics)	2	-	30	-	-	-
Value Education	U19VE51	Value Education	2	1	30	15	35	50
TOTAL			**30**	**25**	**450**	**130**	**370**	**500**

Semester – VI

Course	Code No	Subject	Contact Hrs / Week	Credits	Total No of Hrs Allotted	Max Marks CA	Max Marks SE	Total
Core	UPH19C61	Atomic and Molecular spectra	6	6	90	25	75	100
Core	UPH19C62	Nuclear and particle physics	6	6	90	25	75	100
Core	UPH19C63	Digital Electronics	6	6	90	25	75	100
Elective	UPH19CE61 A/B/C	Introduction to Quantum mechanics/Optical fiber communication/ Electromagnetism	6	6	90	25	75	100
SEC2	UPH19SE41 A/B/C	Practical electric circuits/ Introduction to nanophysics-II/ Medical physics-II	2	2	30	15	35	50
LAB	UPH19CL61	Major Practical-III (General)	2	2	30	40	60	100
LAB	UPH19CL62	Major Practical-IV (Electronics)	2	2	30	40	60	100
			30	**30**	450	195	455	650
Part V		**NCC/ NSS/ PET**		**1**		50	50	100
TOTAL CREDITS FOR SEMESTERS I to VI				**140**				

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE : UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19C11	Properties of Matter	Core 1	3	1	–	3

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

Preamble

This course deals with the theoretical and experimental aspects of basic properties of matter such as elasticity, viscosity, surface tension, diffusion, osmosis and the effects of gravitation on objects. The course is designed to enable students to measure physical quantities associated with the above properties through experiments during laboratory sessions.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Categorize the different moduli of elasticity of materials	K1
CO2	Compare the fluid motion, determine the coefficient of viscosity by different method.	K3
CO3	Realize the concepts of surface tension and its implications.	K3
CO4	Summarize the laws of diffusion and osmosis	K2
CO5	Realize the knowledge of gravitational force between bodies including planets	K1

Mapping of COs with POs

#	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

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total	52	52	140

PROPERTIES OF MATTER

Unit I ELASTICITY: Introduction-different moduli of elasticity-relation between angle of shear and linear strain-relation between volume strain and linear strain-behaviour of a wire under progressive tension-relation between the elastic moduli-torsion of a body-determination of rigidity modulus(static torsion method)-work done in twisting a wire-torsional oscillations of a body-bending of beams-expression for bending moment depression at the midpoint of a beam loaded at the middle-uniform bending of a beam-measurement of Young's modulus.

Unit II VISCOSITY: Introduction-streamline flow and turbulent flow-Poiseuille's formula for the flow of liquid through a capillary tube-corrections to Poiseuille's formula-comparison of viscosities-Ostwald's viscometer-Poiseuille's method for determining the coefficient of viscosity of a liquid-terminal velocity and Stoke's formula-Stoke's method for the coefficient of viscosity of a viscous medium-variation of viscosity with temperature and pressure-friction and lubrication.

Unit III SURFACE TENSION: Introduction-explanation of surface tension on kinetic theory-work done in increasing the area of a surface-work done in blowing a bubble-forms of liquid drops-angle of contact-spreading of one liquid over another-pressure difference across a liquid surface-excess pressure inside a curved liquid surface-Jaegar's method of determining surface tension-variation of surface tension with temperature-Quinke's method- vapour pressure over flat and curved surfaces-drop weight method of determining the surface tension of a liquid-experiment to determine the interfacial tension between water and kerosene.

Unit IV DIFFUSION AND OSMOSIS: Introduction- Fick's law of diffusion- experimental determination of coefficient of diffusion- Graham's law of diffusion of gases-Introduction-experimental determination of osmotic pressure-laws of osmotic pressure-osmosis and vapour pressure of a solution-osmosis and boiling point of a solution- osmosis and freezing point of a solution –determination of molecular weight- determination of percentage of dissociation of an electrolyte.

Unit V GRAVITATION: Newton's law of gravitation- Kepler's law of planetary motion- determination of G-Boy's experiment-gravitational field and gravitational potential-gravitational potential and field due to a spherical shell- gravitational potential and field due to a solid sphere-variation of g with latitude-variation of g with altitude- variation of g with depth- the compound pendulum.

Text Books:

1. Murugeshan,R. 2001.Properties of Matter, S.Chand& Company Ltd., New Delhi (ISBN: 81-219-0605-9)].

References:

1. Mathur, D.S. 2005.Elements of Properties of Matter, S.Chand& Company Ltd, New Delhi (ISBN:81-219-0815-9)]

Web Resources:

1. http://www.physicstutorials.org/home/properties-of-matter
2. http://www.propertiesofmatter.si.edu/contents.html

Course Designers:

1. Mrs.V.RajniSwamy
2. Dr.S.Rajakarthihan

Course Contents and lecture Schedule

Unit	Topic	Lecture hrs.
1.1	Introduction-different moduli of elasticity-relation between angle of shear and linear strain-relation between volume strain and linear strain-behaviour of a wire under progressive tension-relation between the elastic moduli	4
1.2	torsion of a body-determination of rigidity modulus(static torsion method)-work done in twisting a wire-torsional oscillations of a body-bending of beams-	4
1.3	Expression for bending moment depression at the midpoint of a beam loaded at the middle-uniform bending of a beam-measurement of Young's modulus.	4
2.1	Introduction-streamline flow and turbulent flow-Poiseuille's formula for the flow of liquid through a capillary tube-corrections to Poiseuille's formula-comparison of viscosities-	4
2.2	Ostwald's viscometer-Poiseuille's method for determining the coefficient of viscosity of a liquid-terminal velocity and Stoke's formula-	4
2.3	Stoke's method for the coefficient of viscosity of a viscous medium-variation of viscosity with temperature and pressure-friction and lubrication.	4
3.1	Introduction-explanation of surface tension on kinetic theory-work done in increasing the area of a surface-work done in blowing a bubble-forms of liquid drops-angle of contact-spreading of one liquid over another	4
3.2	pressure difference across a liquid surface-excess pressure inside a curved liquid surface-Jaegar's method of determining surface tension-variation of surface tension with temperature-Quinke's method	4
3.3	vapour pressure over flat and curved surfaces-drop weight method of determining the surface tension of a liquid-experiment to determine the interfacial tension between water and kerosene.	4
4.1	Introduction- Fick's law of diffusion- experimental determination of coefficient of diffusion- Graham's law of diffusion of gases-Introduction-experimental determination of osmotic pressure	4
4.2	laws of osmotic pressure -osmosis and vapour pressure of a solution-osmosis and boiling point of a solution- osmosis and freezing point of a solution	4
4.3	Determination of molecular weight- determination of percentage of dissociation of an electrolyte.	4
5.1	Newton's law of gravitation- Kepler's law of planetary motion- determination of G-Boy's experiment-gravitational field and gravitational potential	4
5.2	Gravitational potential and field due to a spherical shell- gravitational potential and field due to a solid sphere	4
5.3	Variation of g with latitude- variation of g with altitude- variation of g with depth-the compound pendulum.	4

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	ELASTICITY	12	Lecture with demo
2	VISCOSITY	12	Lecture with demo
3	SURFACE TENSION	12	Lecture with demo
4	DIFFUSION AND OSMOSIS	12	Lecture
5	GRAVITATION	12	Lecture
Total		60	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE : UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19C12	HEAT AND THERMODYNAMICS	Core 1	3	1		3

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

Preamble

Thermodynamics deals with the study of heat flow and its transformation into energy in the form work in all the three states of matter. This paper deals with kinetic theory of matter, transport phenomena in gases, laws of thermodynamics, concept of entropy and thermodynamical relations which form the basis of thermodynamicalbehaviour of the three states matter.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Recall the basic knowledge on kinetic theory of gases	K1
CO2	Discuss the transport phenomena of the gases	K2
CO3	Categorize the fundamental laws of thermodynamics	K1
CO4	Survey the concept of Entropy and its physical significance	K3
CO5	Analyze the basic principles of thermodynamic potential and applications of Maxwell's thermodynamical relations	K3

Mapping of COs with POs

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

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total marks	52	52	140

Syllabus

HEAT AND THERMODYNAMICS

Unit I KINETIC THEORY OF MATTER: Ideal Gas and Behaviour of Real Gas:Three states of Matter – Concept of Ideal or Perfect Gas – Kinetic Model – Expression for the Pressure Exerted by a Gas – Estimation of r.m.s. Speeds of Molecules – Deduction of Boyle's law – Kinetic Energy per unit Volume of a Gas - Derivation of Gas Equation – Derivation of Gas Laws – Avogadro's Hypothesis – Change of State – Continuity of State – Critical constants – Boyle temperature – Differentiation between Gas and Vapour – Joule-Thomson Effect – Joule-Thomson Porous Plug Experiment.

Unit II TRANSPORT PHENOMENA IN GASES: Molecular Collisions – Mean Free Path – Sphere of influence – Collision Cross-section – Expression for Mean Free Path – Variation of λ with Temperature and Pressure – Transport Phenomena – Viscosity: Transport of Momentum – Effect of Temperature on □ - Effect of Pressure on □ - Thermal Conductivity: Transport of Thermal Energy – Relation between □ and K – Effect of Temperature on K - Effect of Pressure on K – Self Diffusion : Transport of Mass – Effect of Temperature and Pressure – Relation between □ and D.

Unit III THERMODYNAMICS: Laws of Thermodynamics**:** Zeroth Law of Thermodynamic – Concept of Heat – Thermodynamic Equilibrium – Work : A Path Dependent Function – Internal Energy (U) – First Law of Thermodynamics – Specific Heats of Gas – Application of First Law of Thermodynamics – Slope of Adiabatics and Isothermals – Reversible and Irreversible Process – Heat Engines – Definition of Efficiency – Carnot's Ideal Heat Engine – Second law of Thermodynamics – Carnot's Theorem.

Unit IV ENTROPY: Concept of Entropy – Change in Entropy – Change in Entropy in Adiabatic Process - Change of Entropy in Reversible Cycle – Principle of Increase of Entropy – Change of Entropy in Irreversible Cycle – The T-S Diagram – Physical Significance of Entropy – Entropy of a Perfect Gas – Third Law of Thermodynamics – Zero Point Energy – Negative Temperature – Heat Death of Universe.

Unit V THERMODYNAMICAL RELATIONS: Thermodynamic Variables – Extensive and Intensive Variables – Maxwell's Thermodynamical Relations – Joule-Thomson Coefficient(μ) – Clausisus-Clapeyron's Equation - Thermodynamic Potentials – Relation Between C_p, C_v and μ - Entropy and the Second law of Thermodynamics – Joule-Kelvin Coefficient – Equilibrium Between Liquid and its Vapour – First order Phase Transitions – Second Order Phase Transitions.

Text Books:

1. Heat, Thermodynamics and Statistical Physics – Brijlal, Dr.N.Subrahmanyam, P.S.Hemne– ISBN 81-219-2813-3.
   Unit I : Chapter I &II : 1.1 – 1.10, 2.1, 2.2, 2.4 - 2.6, 2.19 - 2.21
   Unit II : Chapter III : 3.1 – 3.18
   Unit III : Chapter IV : 4.2 – 4.7, 4.9, 4.10, 4.14, 4.20 – 4.23, 4.28, 4.29
   Unit IV : Chapter V : 5.1 – 5.9, 5.15 – 5.18
   Unit V : Chapter VI : 6.1 – 6.3, 6.4.3, 6.4.7, 6.5, 6.8, 6.15 - 6.19

References:

1. Nag, P.K. 2005, Basic and applied Thermodynamics, Tata McGraw – Hill company Ltd.

Web Resources:

1. http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
2. https://nptel.ac.in/

Course Designers:

1. Mr.M.Venkatachalam Mrs.R.Dhanalakshmi

Course Contents and lecture Schedule

Unit	Topic	Lecture hrs.
1.1	Three states of Matter – Concept of Ideal or Perfect Gas – Kinetic Model – Expression for the Pressure Exerted by a Gas – Estimation of r.m.s. Speeds of Molecules – Deduction of Boyle's law	4
1.2	Kinetic Energy per unit Volume of a Gas - Derivation of Gas Equation – Derivation of Gas Laws – Avogadro's Hypothesis – Change of State – Continuity of State – Critical constants	4
1.3	Boyle temperature – Differentiation between Gas and Vapour – Joule-Thomson Effect – Joule-Thomson Porous Plug Experiment.	4
2.1	Molecular Collisions – Mean Free Path – Sphere of influence – Collision Cross-section – Expression for Mean Free Path – Variation of λ with Temperature and Pressure – Transport Phenomena – Viscosity: Transport of Momentum	4
2.2	Effect of Temperature on η - Effect of Pressure on η - Thermal Conductivity: Transport of Thermal Energy – Relation between η and K – Effect of Temperature on K	4
2.3	Effect of Pressure on K – Self Diffusion : Transport of Mass – Effect of Temperature and Pressure – Relation between η and D.	4
3.1	Zeroth Law of Thermodynamic – Concept of Heat – Thermodynamic Equilibrium – Work : A Path Dependent Function – Internal Energy (U) – First Law of Thermodynamics	4
3.2	– Specific Heats of Gas – Application of First Law of Thermodynamics – Slope of Adiabatics and Isothermals – Reversible and Irreversible Process	4
3.3	Heat Engines – Definition of Efficiency – Carnot's Ideal Heat Engine – Second law of Thermodynamics – Carnot's Theorem.	4
4.1	Concept of Entropy – Change in Entropy – Change in Entropy in Adiabatic Process - Change of Entropy in Reversible Cycle – Principle of Increase of Entropy	4
4.2	Change of Entropy in Irreversible Cycle – The T-S Diagram – Physical Significance of Entropy	4
4.3	Entropy of a Perfect Gas – Third Law of Thermodynamics – Zero Point Energy – Negative Temperature – Heat Death of Universe.	4
5.1	Thermodynamic Variables – Extensive and Intensive Variables – Maxwell's Thermodynamical Relations – Joule-Thomson Coefficient(μ)	4
5.2	Clausisus-Clapeyron's Equation - Thermodynamic Potentials – Relation Between c_p, c_v and μ - Entropy and the Second law of Thermodynamics	4
5.3	Joule-Kelvin Coefficient – Equilibrium Between Liquid and its Vapour – First order Phase Transitions – Second Order Phase Transitions.	4

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	KINETIC THEORY OF MATTER	12	Lecture with demo
2	TRANSPORT PHENOMENA IN GASES	12	Lecture with demo
3	THERMODYNAMICS	12	Lecture
4	ENTROPY	12	Lecture
5	THERMODYNAMICAL RELATIONS	12	Lecture
Total		60	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE : UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19C21	MECHANICS	Core 1	3	1		3

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

Preamble

Mechanics deals with the motion of objects and the effect of external forces acting on them. Understanding the motion of objects and attempts to comprehend the laws governing them dates back to at least two thousand years. However, a systematic approach to the study of mechanics began with Sir Isaac Newton's contribution in providing conclusive mathematical formulation based on accurate observations. This deals with the laws of motion, concepts of system of particles, dynamics of rigid bodies and oscillations.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Analyze the laws of motion and central force	K1
CO2	Discuss the centre of mass of a rigid body-motion	K2
CO3	Explain the Dynamics of rigid bodies	K1
CO4	Evaluate the moment of inertia of rigid bodies	K3
CO5	Interpret oscillations of mechanical systems	K3

Mapping of COs with POs

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

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total	52	52	140

Syllabus

MECHANICS

Unit I LAWS OF MOTION AND CENTRAL FORCE : Newton's first law of motion-second law of motion-resistive force -constant force and resistive force -conservative force-motion in a plane – cylindrical polar coordinates- Spherical polar coordinates-Uniformly rotating frame of reference-Focault`s pendulum- Coriolis forces and motion relative to earth.

Unit II SYSTEM OF PARTICLES : Dynamics of a system of particles and concept of Rigid bodies-centre of mass coordinates – Centre of mass of a rigid body-motion of centre of mass and linear momentum-angular momentum and torque-angular momentum of a system and centre of mass – conservation of angular momentum-Collisions-Inelastic collision-coefficient of restitution.

Unit III DYNAMICS OF RIGID BODIES I : Rigid bodies-rotational kinetic energy, moment of inertia and its physical significance-angular acceleration-angular momentum-law of conservation of angular momentum-torque-torque as a cross product of F & r –analogy between translatory motion and rotatory motion –work done by a torque- Theorem of perpendicular axes-theorem of parallel axes

Unit IV DYNAMICS OF RIGID BODIES II : Moment of inertia of thin uniform bar- Moment of inertia of a rectangular lamina- Moment of inertia of a uniform circular disc- Moment of inertia of an annular disc- Moment of inertia of a hollow cylinder - Moment of inertia of a solid sphere- Moment of inertia of a spherical shell- Moment of inertia of a solid cone-Routh`s rule-Kinetic energy of a body rolling on a horizontal plane-acceleration of a body rolling down an inclined plane.

Unit V OSCILLATIONS : Linear harmonic oscillator-energy of a simple harmonic oscillator –simple harmonic oscillations of a loaded spring-Helmholtz resonator-Oscillations of two masses connected by a spring-Damped harmonic oscillators-energy of a damped harmonic oscillator.

Text Books:

1. Brijlal, N.Subrahmanyam&JivanSeshan. 2005, Mechanics and Electrodynamics, S.Chand& Company Ltd, New Delhi (ISBN:81-219-2591-6)]
   UNIT I : Chapter 4 [4.1-4.9, 4.11]
   UNIT II : Chapter 6 [6.1-6.10]
   UNIT III: Chapter 7 [7.1-7.11]
   UNIT IV: Chapter 7[7.12, 7.15, 7.18-7.21, 7.23, 7.26-7.29]
   UNIT V: Chapter 8[8.2-8.4, 8.10, 8.11, 8.15, 8.16]

References:

1. Mathur, D.S. 2005, Elements of Properties of Matter, S.Chand& Company Ltd , New Delhi (ISBN:81-219-0815-9)]

Web Resources:

1. http://edtechreview.in/news/2142-online-resources-and-tools-for-physics-teachers
2. http://www.batesville.k12.in.us/physics/PhyNet/Mechanics/MechOverview.html
3. http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html

Course Designers:

1. Mrs.V.RajniSwamy
2. Dr.S.Rajakarthihan

Course Contents and lecture Schedule

Unit	Topic	Lecture hrs.
1.1	Newton's first law of motion-second law of motion-resistive force -constant force and resistive force	4
1.2	conservative force-motion in a plane –cylindrical polar coordinates- Spherical polar coordinates-	4
1.3	Uniformly rotating frame of reference-Focault`s pendulum- Coriolis forces and motion relative to earth.	4
2.1	Dynamics of a system of particles and concept of Rigid bodies-centre of mass coordinates – Centre of mass of a rigid body	4
2.2	motion of centre of mass and linear momentum-angular momentum and torque-angular momentum of a system	4
2.3	centre of mass –conservation of angular momentum-Collisions-Inelastic collision-coefficient of restitution.	4
3.1	Rigid bodies-rotational kinetic energy, moment of inertia and its physical significance-angular acceleration-angular momentum	4
3.2	law of conservation of angular momentum-torque-torque as a cross product of F & r	4
3.3	analogy between translatory motion and rotatory motion –work done by a torque- Theorem of perpendicular axes-theorem of parallel axes	4
4.1	Moment of inertia of thin uniform bar- Moment of inertia of a rectangular lamina- Moment of inertia of a uniform circular disc- Moment of inertia of an annular disc	4
4.2	Moment of inertia of a hollow cylinder - Moment of inertia of a solid sphere-Moment of inertia of a spherical shell- Moment of inertia of a solid cone	4
4.3	Routh`s rule-Kinetic energy of a body rolling on a horizontal plane-acceleration of a body rolling down an inclined plane.	4
5.1	Linear harmonic oscillator-energy of a simple harmonic oscillator	4
5.2	simple harmonic oscillations of a loaded spring-Helmholtz resonator-	4
5.3	Oscillations of two masses connected by a spring-Damped harmonic oscillators-energy of a damped harmonic oscillator.	4

Course Contents and lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	LAWS OF MOTION AND CENTRAL FORCE	12	Lecture with demo
2	SYSTEM OF PARTICLES	12	Lecture
3	DYNAMICS OF RIGID BODIES I	12	Lecture with demo
4	DYNAMICS OF RIGID BODIES II	12	Lecture with demo
5	OSCILLATIONS	12	Lecture with demo
Total		60	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE : UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19C22	OPTICS	Core 1	3	1		3

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

Preamble

Optics is an important branch of Physics which deals with the properties of light and its interaction with matter. Of the many properties of light, reflection, refraction and dispersion require light to be treated as rays and require geometrical approach to understand them. This forms a separate branch in optics called geometric optics. Study of phenomena such as interference, diffraction and polarization requires light to be treated as waves and is known as physical optics. This paper deals with the concepts of both geometrical and physical optics.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Recall the laws of refraction, reflection and the terminology of lenses	K1
CO2	Appraise the phenomena of Dispersion	K2
CO3	Describe the optical interference mechanism.	K2
CO4	Acquire the knowledge on creating the optical diffraction phenomena	K2
CO5	Apply the basic concepts of polarization phenomena	K2, K3

Mapping of COs with POs

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

Blooms taxonomy

Bloom's category	Continuous Assessment Tests		Terminal Examination
	I	II	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	52	52	140

Syllabus

OPTICS

Unit I LIGHT AND LENS: Introduction to light –Fermat's Principle of Least time-Rectilinear propagation of light-Laws of Reflection-Laws of Refraction- Total internal reflection- Lenses-terminology-conjugate points –planes and distances-image tracing-location of the image-sign convention-thin lens-lens equation-lens maker`s equation-power-equivalent focal length of two thin lenses.

Unit II DISPERSION: Dispersion by a prism-Refraction through a prism-Angular dispersion-Dispersive power-Angular and chromatic dispersions-Achromatic combination of prisms-Deviation without dispersion-dispersion without deviation-Direct vision spectroscope.

Unit III INTERFERENCE: Coherence – Conditions for interference – Techniques of obtaining interference - Fresnel Biprism – Achromatic fringes – Interferometry – Thin film – Plane parallel film – Interference due to transmitted light – Haidinger fringes – Variable thickness (Wedge-shaped) film – Newton's rings- Michelson's interferometer

Unit IV DIFFRACTION: Huygen‟ s – Fresnel theory - Zone plate – Distinction between interference and diffraction – fresnel, Fraunhoffer types of diffraction – Diffraction at a circular aperture– diffraction pattern due to a straight edge-Fraunhoffer diffraction at a single slit, circular aperture – Plane diffraction grating

Unit V POLARIZATION: Polarized light – Production of linearly polarized light – Polarizer and analyzer – Anisotropic crystals – Calcite crystal – Huygens' explanation of double refraction – Phase difference between e-ray and o-ray – Superposition of waves linearly at right angles – Types of polarized light – Effect of polarizer on transmission of polarized light – Retarders or wave plates – Production of elliptically and circularly polarized light – analysis of polarized light – Optical activity – Specific rotation – Laurent‟ s half-shaded polarimeter.

Text Books:

1. Brijlal N Subrahmanyam., Avadhanulu M.N., 2006, A Text Book Of Optics, S.Chand& Company Ltd, New Delhi (ISBN:81-219-2611-4)

References:

1. Jenkins, F.A., White H.E., 1981, Fundamentals Of Optics, 4th Edition, McGraw- Hill Book Company, (ISBN:0-07-032330-5)

Web Resources:

1. https://blossoms.mit.edu/resources/physics_resources
2. https://micro.magnet.fsu.edu/optics/webresources/index.html
3. http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html

Course Designers:

1. Mr.M.Venkatachalam
2. Mrs.R.Sribala

Course Contents and lecture Schedule

Unit	Topic	Lecture hrs.
1.1	Introduction to light –Fermat's Principle of Least time-Rectilinear propagation of light-Laws of Reflection-Laws of Refraction	4
1.2	Total internal reflection- Lenses-terminology-conjugate points –planes and distances-image tracing-location of the image	4
1.3	sign convention-thin lens-lens equation-lens maker`s equation-power-equivalent focal length of two thin lenses.	4
2.1	Dispersion by a prism-Refraction through a prism-Angular dispersion-Dispersive power	4
2.2	Angular and chromatic dispersions-Achromatic combination of prisms-Deviation without dispersion	4
2.3	dispersion without deviation-Direct vision spectroscope	4
3.1	Coherence – Conditions for interference – Techniques of obtaining interference - Fresnel Biprism	4
3.2	Achromatic fringes – Interferometry – Thin film – Plane parallel film – Interference due to transmitted light	4
3.3	Haidinger fringes – Variable thickness (Wedge-shaped) film – Newton's rings- Michelson's interferometer	4
4.1	Huygen's – Fresnel theory - Zone plate – Distinction between interference and diffraction – fresnel, Fraunhoffer types of diffraction	4
4.2	Diffraction at a circular aperture– diffraction pattern due to a straight edge	4
4.3	Fraunhoffer diffraction at a single slit, circular aperture – Plane diffraction grating	4
5.1	Polarized light – Production of linearly polarized light – Polarizer and analyzer – Anisotropic crystals – Calcite crystal – Huygens' explanation of double refraction	4
5.2	Phase difference between e-ray and o-ray – Superposition of waves linearly at right angles – Types of polarized light – Effect of polarizer on transmission of polarized light	4
5.3	Retarders or wave plates – Production of elliptically and circularly polarized light – analysis of polarized light – Optical activity – Specific rotation – Laurent's half-shaded polarimeter.	4

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	LIGHT AND LENS	12	Lecture
2	DISPERSION	12	Lecture with demo
3	INTERFERENCE	12	Lecture with demo
4	DIFFRACTION	12	Lecture with demo
5	POLARIZATION	12	Lecture with demo
Total		**60**	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE : UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19AE21	DATA ANALYSIS AND INTERPRETATION	AECC	2			2

Year	Semester	Int. Marks	Ext.Marks	Total
First	Second	15	35	50

Preamble

Data analysis and interpretation of measured quantities using an experimental set up is crucial in any laboratory experiment. Graphical representation of such measured quantities makes it easier to understand the underlying principles of a physics concept. This paper deals with the essentials of data analysis and interpretation.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Perceive the knowledge on uncertainties in measurements	K1
CO2	Categorize the types of function	K2, K3

Mapping of COs with POs

#	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	L	M	S
CO2	M	S	M	S	M

Blooms taxonomy

Bloom's category	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	30	30	65

Syllabus

DATA ANALYSIS AND INTERPRETATION

Unit I ERROR ANALYSIS OF DATA: Significant figures – Discrepancy- comparison of two measured numbers- checking proportionality with a graph- fractional uncertainities-uncertainity in sums and differences:products and quotients:power-random and systematic errors- the mean and standard deviation

Unit II REPERSENTATION OF DATA: Graphs of basic type of functions (linear, quadratic, power, polynomial, rational, exponential, logarithmic, sinusoidal) and their physical interpretation-Examples

Text Books:

John R. Taylor. 1982. An Introduction to Error Analysis The Study Of Uncertainties In Physical Measurements, United states of America, University Science Books.

References:

N.C.Barford, 1969. Experimental Measurements: Precision, Error and Truth,Addison Wesley Publishing Company, London.

Web Resources:

1. https://www.vicphysics.org/analysis.html
2. https://www.edx.org/course/subject/data-analysis-statistics
3. https://www.learner.org/resources/series158.html

Course Designers:

Dr.J.Suvetha Rani

Course Contents and lecture Schedule

Unit	Topic	Lecture hrs.
1.1	Significant figures – Discrepancy- comparison of two measured numbers	5
1.2	checking proportionality with a graph- fractional uncertainities-uncertainity in sums and differences	5
1.3	products and quotients:power-random and systematic errors- the mean and standard deviation	5
2.1	Graphs of basic type of functions (linear, quadratic	5
2.2	power, polynomial, rational, exponential, logarithmic, sinusoidal	5
2.3	physical interpretation-Examples	5

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	ERROR ANALYSIS OF DATA	15	Lecture with Practice
2	REPERSENTATION OF DATA	15	Lecture with Practice
Total		30	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19C31	ELECTRICITY & MAGNETISM	Core 1	4			4

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

Preamble

- Know the basics of electricity and magnetism.
- Enhance the application skills by relating the phenomena of electricity and magnetism with daily activities.
- Understand the applications of scalar and vector potentials of magnetostatics.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Recall Gauss`s law and to relate it to various applications	K1
CO2	Classify electric potential and electric field and categorize the capacitor types	K1,K2
CO3	Analyze and apply the concepts of current electricity, transient currents and alternating current.	K1,K2,K3
CO4	Categorize the types of magnetic materials	K2
CO5	Outline the concepts of magnetostatic scalar and vector potentials and relate it with Hall Effect	K2,K3

Mapping of COs with POs

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

Blooms taxonomy

Bloom's category	Continuous Assessment Tests		Terminal Examination
	I	II	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	52	52	140

Syllabus

ELECTRICITY & MAGNETISM

Unit I: GAUSS'S LAW AND ITS APPLICATIONS: Flux of the electric field – Gauss's law – Differential form of Gauss's law –Applications of Gauss's law –an insulated conductor- Electric field due to a uniformly charged sphere – an isolated uniformly charged conducting sphere – Uniform Infinite cylindrical charge – an infinite plane sheet of charge – two parallel sheets of charge – Coulomb's theorem.

Unit II ELECTRIC POTENTIAL: Electric Potential – Relation between Electric field and Electric potential – Potential at a point due to a uniformly charged conducting sphere – due to a uniformly charged non conducting solid sphere – Potential and field due to an electric dipole – Electric Potential Energy. CAPACITANCE AND CAPACITORS Introduction – Capacitance of a Spherical Capacitor - Outer Sphere Earthed – Inner Sphere Earthed – Cylindrical Capacitor – Parallel plate Capacitor – Effect of a Dielectric – Capacitors in Series and Parallel –Energy stored in a charged capacitor – Types of Capacitors.

Unit III CURRENT ELECTRICITY: Current and Expression for current density – Equations of Continuity – Ohm's law and Electrical Conductivity – Drude –Lorentz theory of electrical conduction- Kirchhoff's laws – Applications of Kirchhoff's laws to Wheatstone's network.

TRANSIENT CURRENTS: Growth of a current in a circuit containing a resistance and inductance – Decay of current in a circuit containing L and R – Charge and Discharge of a Capacitor through R – Measurement of High resistance by leakage – Growth of charge in LCR Circuit – Decay of charge in LCR circuit.

ALTERNATING CURRENTS: EMF induced in a coil rotating in a magnetic field – Peak, average and RMS values of Voltage and current – Series and Parallel resonant circuits – Power in an A.C. circuit – Wattless current – Choke coil – The transformer.

Unit IV MAGNETIC PROPERTIES OF MATERIALS : Magnetic induction – magnetization – Relation between the three magnetic vectors - Susceptibility, permeability – Properties of Dia, Para, Ferro magnetic materials – The Electron theory of Magnetism – Langevin's theory of Dia, Para magnetism – Weiss theory of Ferro Magnetism – Experiment to draw B-H Curve – Energy loss due to Hysteresis.

Unit V MAGNETOSTATICS : Magnetic vector potential – Magnetic field for a long straight current carrying wire – magnetic scalar potential – application of magnetic scalar potential: Equivalence of a small current loop and a magnetic dipole – Electric field vector in terms of scalar and vector potentials – Magnetic shell – Potential at any point due to a magnetic shell – Magnetic potential and field at a point on the axis of a flat circular magnetic shell – Equivalence of magnetic shell and current circuit – The Hall effect.

Text Books:

Murugeshan, R. 2011,Electricity and Magnetism, Nineth revised edition., S.Chand& Company Ltd, New Delhi,.[ISBN:81-219-1705-0]
(Unit I Sec. 2.1 –2.6, 2.8- 2.11, Unit II Sec. 3.1 – 3.8, 4.1 – 4.6, 4.8, 4.9, 4.13, Unit III Sec. 6.1-6.6, 12.1-12.6, 13.1-13.7,Unit IV Sec. 15.1-15.13, 15.15, 15.16, Unit V Sec 22.1-22.10)

References:

Kip, A.F. 1969, Fundamentals of Electricity and Magnetism, ,2nd edition., McGraw-Hill, New York.

Web Resources:

1. http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html
2. http://nptel.ac.in
3. https://study.com/academy/lesson/electromagnetic-induction-definition-variables-that-affect-induction.html

Course Designers:

1. Mrs.V.RajniSwamy Mrs.R.Dhanalakshmi

Course contents and lecture schedule

Unit	Topic	Lecture hrs.
1.1	Flux of the electric field – Gauss's law – Differential form of Gauss's law – Applications of Gauss's law –an insulated conductor	4
1.2	Electric field due to a Uniformly charged sphere – an isolated uniformly charged conducting sphere	4
1.3	Uniform Infinite cylindrical charge – an infinite plane sheet of charge – two parallel sheets of charge – Coulomb's theorem.	4
2.1	Electric Potential – Relation between Electric field and Electric potential – Potential at a point due to a uniformly charged conducting sphere – due to a uniformly charged non conducting solid sphere	4
2.2	Potential and field due to an electric dipole – Electric Potential Energy. Capacitance and capacitors Introduction – Capacitance of a Spherical Capacitor - Outer Sphere Earthed – InnerSphere Earthed	4
2.3	Cylindrical Capacitor – Parallel plate Capacitor – Effect of a Dielectric – Capacitors in Series and Parallel –Energy stored in a charged capacitor – Types of Capacitors.	4
3.1	Current and Expression for current density – Equations of Continuity – Ohm's law and Electrical Conductivity – Drude –Lorentz theory of electrical cionduction-Kirchhoff's laws – Applications of Kirchhoff's laws to Wheatstone's network.	4
3.2	Growth of a current in a circuit containing a resistance and inductance – Decay of current in a circuit containing L and R – Charge and Discharge of a Capacitor through R – Measurement of High resistance by leakage – Growth of charge in LCR Circuit – Decay of charge in LCR circuit.	4
3.3	EMF induced in a coil rotating in a magnetic field – Peak, average and RMS values of Voltage and current – Series and Parallel resonant circuits – Power in an A.C. circuit – Wattless current – Choke coil – The transformer.	4
4.1	Magnetic induction – magnetization – Relation between the three magnetic vectors - Susceptibility, permeability	4
4.2	Properties of Dia, Para, Ferro magnetic materials – The Electron theory of Magnetism – Langevin's theory of Dia, Para magnetism	4
4.3	Weiss theory of Ferro Magnetism – Experiment to draw B-H Curve – Energy loss due to Hysteresis.	4
5.1	Magnetic vector potential – Magnetic field for a long straight current carrying wire – magnetic scalar potential – application of magnetic scalar potential: Equivalence of a small current loop and a magnetic dipole	4
5.2	Electric field vector in terms of scalar and vector potentials – Magnetic shell – Potential at any point due to a magnetic shell	4

5.3	Magnetic potential and field at a point on the axis of a flat circular magnetic shell – Equivalence of magnetic shell and current circuit – The Hall effect.	4

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	GAUSS'S LAW AND ITS APPLICATIONS	12	Lecture with Practice
2	ELECTRIC POTENTIAL	12	Lecture with Demo
3	CURRENT ELECTRICITY, TRANSIENT CURRENTS & ALTERNATING CURRENTS	12	Lecture with Practice
4	MAGNETIC PROPERTIES OF MATERIALS	12	Lecture with Demo
5	MAGNETOSTATICS	12	Lecture with Practice
Total		60	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19C32	MODERN OPTICS	Core 1	4			4

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

Preamble

- Understand a broad overview of the various optical instruments.
- Know about laser and the basis of holography
- Appreciate the fibre optics and nonlinear optical phenomena**.**

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Explain the various types of optical instrument and its construction	K1
CO2	Outline the characteristics and principle of lasers	K1
CO3	Interpret the images produced by Holography and its applications	K2
CO4	Classify the types of optical fibers	K2,K3
CO5	Elaborate the phenomena of wave propagation and non-linear polarization	K3

Mapping of COs with POs

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

Blooms taxonomy

Bloom's category	Continuous Assessment Tests		Terminal Examination
	I	II	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	52	52	140

Syllabus

MODERN OPTICS

Unit I OPTICAL INSTRUMENTS: The Eye – Camera – Size of an object – The Simple Magnifier – Field of view – Stops and Pupils – Objective and Eyepiece – Huygen's Eyepiece – Ramsden Eyepiece – Comparison of Ramsden Eyepiece with Huygen's Eyepiece – Compound Microscope – Telescopes – Reflecting Telescope – Constant Deviation Spectrometer – Abbe Refractrometer.

Unit II LASERS: Attenuation of light in an optical medium – thermal equilibrium – Interaction of light with matter – Einstein`s relations-Light Amplification- Population inversion – Active medium – Pumping – Metastable states –Principal pumping schemes – Optical resonant cavity-Axial modes-Types of lasers – Ruby, He-Ne, CO2 Laser – Laser beam characteristics-Applications.

Unit III HOLOGRAPHY: Introduction - Principle of holography – Theory- Important properties of a hologram – Advances -Applications.

Unit IV FIBRE OPTICS: Introduction – Optical Fiber – Critical Angle of Propagation – Modes of Propagation – Acceptance Angle – Fractional Refractive index change – Numerical Aperture – Types of Optical Fibers – Normalized Frequency – Pulse Dispersion – Attenuation – Applications – Fiber Optic Communication Systems – Advantages.

Unit V NON-LINEAR OPTICS: Introduction – Wave Propagation and Momentum Conservation – Linear Medium – Nonlinear Polarization – Second Harmonic Generation – Phase Matching – Sum and Difference Frequency Generation – Parametric Oscillation – Self-Focussing of Light – Stimulated Raman Scattering.

Text Books:

Subrahmanyam, BrijLal N. &Avadhanulu, M.N. 2006, A Text Book Of Optics, S. Chand and Company Ltd, New Delhi (ISBN:81-219-2611-4).

References:

Jenkins F.A., White H.E, 1981.Fundamentals Of Optics, 4th Edition, Mcgraw- Hill Book Company, (ISBN:0-07-032330-5).

Web Resources:

1. https://www.leoni-fiber-optics.com
2. https://phys.libretexts.org

Course Designers:

Mr.M.Venkatachalam&Dr.S.Rajakarthihan

Course Contents and lecture Schedule

Unit	Topic	Lecture hrs.
1.1	The Eye – Camera – Size of an object – The Simple Magnifier – Field of view – Stops and Pupils – Objective and Eyepiece	4
1.2	Huygen's Eyepiece – Ramsden Eyepiece – Comparison of Ramsden Eyepiece with Huygen's Eyepiece	4
1.3	Compound Microscope – Telescopes – Reflecting Telescope – Constant Deviation Spectrometer – Abbe Refractrometer.	4
2.1	Attenuation of light in an optical medium – thermal equilibrium – Interaction of light with matter – Einstein`s relations	4

2.2	Light Amplification- Population inversion – Active medium – Pumping – Metastable states –Principal pumping schemes	4
2.3	Optical resonant cavity-Axial modes-Types of lasers – Ruby, He-Ne, CO2 Laser – Laser beam characteristics-Applications.	4
3.1	Introduction - Principle of holography	4
3.2	Theory- Important properties of a hologram	4
3.3	Advances -Applications.	4
4.1	Introduction – Optical Fiber – Critical Angle of Propagation – Modes of Propagation – Acceptance Angle	4
4.2	Fractional Refractive index change – Numerical Aperture – Types of Optical Fibers – Normalized Frequency	4
4.3	Pulse Dispersion – Attenuation – Applications – Fiber Optic Communication Systems – Advantages.	4
5.1	Introduction – Wave Propagation and Momentum Conservation – Linear Medium – Nonlinear Polarization	4
5.2	Second Harmonic Generation – Phase Matching – Sum and Difference Frequency Generation	4
5.3	Parametric Oscillation – Self-Focussing of Light – Stimulated Raman Scattering.	4

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	OPTICAL INSTRUMENTS	12	Lecture with demo
2	LASERS	12	Lecture with demo
3	HOLOGRAPHY I	12	Lecture with demo
4	FIBRE OPTICS	12	Lecture with demo
5	NON -LINEAR OPTICS	12	Lecture with demo
Total		60	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19NE31	SOLAR ENERGY	Non-major Elective I	2			2

Year	Semester	Int. Marks	Ext.Marks	Total
Second	Third	15	35	100

Preamble

- Explain the available Non-conventional Energy sources
- Describe the working principle of Solar devices

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Acquire the knowledge about the types of conventional energy sources	K1
CO2	Apply the modern energy harvesting techniques in daily life.	K2, K3

Mapping of COs with POs

#	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	M	X	M
CO2	S	L	M	L	S

Blooms taxonomy

Bloom's Category	Continuous Assessment Tests		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**30**	**30**	**65**

Syllabus

SOLAR ENERGY

Unit I SOLAR ENERGY Conventional Energy sources – Renewable Energy sources- Solar Energy- Solar radiation and measurements- Solar constant- Solar radiation at the Earth's surface- Solar radiation

measurements- Physical principle of the conversion of solar radiation into heat- Concentrating collectors - Storage of solar energy- Thermal storage.

Unit II APPLICATION OF SOLAR ENERGY Solar Water Heating- Solar cells- Basic Photovoltaic system for power generation- Solar distillation- solar pumping- solar cooking.

Text Books:

Rai G.D., 2011, Non-Conventional Energy Sources, Reprint, Khanna Publishers, New Delhi

References:

Sukhatme S.P. 1984. Solar Energy Principles thermal collection and storage, Tata McGraw Hill publications

Web Resources:

http://www.environmentalpollution.in

Course Designers:

Dr.S.Rajakarthihan

Course Contents and lecture Schedule

Unit	Topic	Lecture hrs.
1.1	Conventional Energy sources – Renewable Energy sources	5
1.2	Solar Energy- Solar radiation and measurements- Solar constant- Solar radiation at the Earth's surface- Solar radiation measurements	7
1.3	Physical principle of the conversion of solar radiation into heat- Concentrating collectors - Storage of solar energy- Thermal storage.	6
2.1	Solar Water Heating	4
2.2	Solar cells- Basic Photovoltaic system for power generation	4
2.3	Solar distillation- solar pumping- solar cooking	4

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	SOLAR ENERGY	18	Lecture with Demo
2	APPLICATION OF SOLAR ENERGY	12	Lecture with hands-on
Total		30	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19C41	**MATERIALS SCIENCE**	**Core 1**	**4**			**4**

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

Preamble

- Understand the phase rule and phase transformation
- Appreciate the applications of phase diagrams
- Understand the mechanism of creep and corrosion
- Know about the new materials

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Acquiring knowledge about the basics of phase Diagrams	K1
CO2	Recognize the phase transformation	K1 , K2
CO3	Appreciate the mechanism of creep	K1 , K2
CO4	Comprehend the mechanism of fracture, Corrosion	K1, K3
CO5	Know about the new materials	K1, K2

Mapping of COs with POs

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

Blooms taxonomy

Bloom's category	Continuous Assessment Tests		Terminal Examination
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	140

Syllabus

MATERIALS SCIENCE

Unit I PHASE DIAGRAMS: The phase rule- single component system- binary phase diagram- microstructural changes during cooling-the lever rule- some typical phase diagrams- other applications of phase diagrams

Unit II PHASE TRANSFORMATIONS: Time scale for phase changes- the nucleation kinetics- the growth and the overall transformation kinetics- transformation in steel-precepitation processes- solidification and crystallization- the glass transition- recovery, recrystallization and grain growth

Unit III PLASTIC DEFORMATION AND CREEP IN CRYSTALLINE MATERIALS: The tensile stress-strain curve- phase deformation by slip-the shear strength of perfect and real crystals- multiplication of dislocations during deformation-the effect of grain size on dislocation motion-the effect of solute atoms on dislocation motion- the effect of precipitate particles on dislocation motion- mechanism of creep-creep resistant materials

Unit IV FRACTURES, OXIDATION AND CORROSION: Fractures in materials – Ductile fracture – Brittle fracture – Fracture toughness – The ductile-brittle transition – Methods of protection fracture – Fatigue fracture – Oxidation and Corrosion – Mechanisms of oxidation – Oxidation resistant materials – The principles of corrosion – Protection against corrosion.

Unit V NEW MATERIALS: Introduction- Metallic glasses- fiber reinforced plastics and finer reinforced metals-metal matrix composites- surface acoustic wave materials-biomaterials- ceramics- cermets- high temperature materials- thermoelectric materials- electrets- nuclear engineering materials- nanophase materials- intermetallic compounds- shape memory alloys- SMART materials- conducting polymers

Text Books:

1. Raghavan, V. 2003. Materials Science and Engineering – A First Course, 4th Ed., Prentice-Hall of India (ISBN: 81-203-1261-9)
2. Arumugam, M. 2002. Materials Science, 3rd Ed., Anuradha Agencies, India.

References:

Manchandra VK. 1992.A text book of Materials Science, New India Publishing House

Web Resources:

1. *https://en.wikipedia.org/wiki/Phase_diagram*
2. *https://en.wikipedia.org/wiki/Phase_transition*
3. https://nptel.ac.in/courses/113108051/module1/lecture1.pdf

Course Designers:

1. Mrs.R.Dhanalakshmi
2. Dr.S.Rajakarthihan

Course Contents and lecture Schedule

Unit	Topic	Lecture hrs.
1.1	The phase rule- single component system- binary phase diagram	4
1.2	microstructural changes during cooling-the lever rule	4
1.3	some typical phase diagrams- other applications of phase diagrams	4

2.1	Time scale for phase changes- the nucleation kinetics	4
2.2	the growth and the overall transformation kinetics- transformation in steel-precepitation processes	4
2.3	solidification and crystallization- the glass transition- recovery, recrystallization and grain growth	4
3.1	The tensile stress-strain curve- phase deformation by slip-the shear strength of perfect and real crystals- multiplication of dislocations during deformation	4
3.2	the effect of grain size on dislocation motion-the effect of solute atoms on dislocation motion	4
3.3	the effect of precipitate particles on dislocation motion- mechanism of creep-creep resistant materials	4
4.1	Fractures in materials – Ductile fracture – Brittle fracture – Fracture toughness – The ductile-brittle transition	4
4.2	Methods of protection fracture – Fatigue fracture – Oxidation and Corrosion – Mechanisms of oxidation	4
4.3	Oxidation resistant materials – The principles of corrosion – Protection against corrosion.	4
5.1	Introduction- Metallic glasses- fiber reinforced plastics and finer reinforced metals-metal matrix composites- surface acoustic wave materials-biomaterials	4
5.2	ceramics- cermets- high temperature materials- thermoelectric materials- electrets- nuclear engineering materials	4
5.3	nanophase materials- intermetallic compounds- shape memory alloys-SMART materials- conducting polymers	4

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	PHASE DIAGRAMS	12	Lecture with PPT
2	PHASE TRANSFORMATIONS	12	Lecture with PPT
3	PLASTIC DEFORMATION AND CREEP IN CRYSTALLINE MATERIALS	12	Lecture with PPT
4	FRACTURES, OXIDATION AND CORROSION	12	Lecture with PPT
5	NEW MATERIALS	12	Lecture with PPT
Total		60	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19 C42	FUNDAMENTALS OF ELECTRONICS	Core 1	4			4

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

Preamble

- Appreciate the development of electronics in discrete components
- Provide the fundamental aspects regarding the design of analog electronic circuits for various applications.
- Evaluate the functioning of unipolar and bipolar junction transistors

Course Outcomes

#	Course Outcome	Knowledge Level
CO1	Realize the basic concepts of Thevenin& Norton's Theorem	K1, K2
CO2	Understand the characteristics PN junction diode and their applications	K1, K3
CO3	Demonstrating the applications of Diode	K2 , K3
CO4	Realize the basics of concepts of transistor biasing	K1, K3
CO5	Comprehend the basic concepts of Field effect Transistor	K1, K2

Mapping of COs with POs

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

Blooms taxonomy

Bloom's Category	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	140

Syllabus

FUNDAMENTALS OF ELECTRONICS

Unit I BASIC CIRCUIT ANALYSIS: Voltage source- constant voltage source- constant current source- conversion of voltage source into current source- maximum power transfer theorem- Thevenin's theorem- procedure for finding Thevenin equivalent circuit- Norton's theorem- Procedure for finding Norton equivalent circuit- Chassis and ground

Unit II SEMICONDUCTOR DIODE:PN junction- properties of PN junction- biasing a PN junction- current flow in a forward biased PN junction- Volt- Ampere characteristics of PN junction- Semiconductor diode- crystal diode as a rectifier-Resistance of crystal diode- half wave rectifier- full – wave rectifiers-efficiency of HWR and FWR- bridge rectifier-efficiency-ripple factor

Unit III FILTER CIRCUITS AND APPLICATIONS OF DIODES: Filter circuits- Capacitor filter- choke input filter- capacitor input filter- voltage multipliers- half-wave voltage doubler- Zener diode- equivalent circuit of zener diode- zener diode as voltage stabilizer- clipping circuits- positive clipper- biased clipper- combination clipper- Application of clippers- clamping circuits- Basic idea of a clamper- positive clamper- negative clamper

Unit IV TRANSISTOR AND TRANSISTOR BIASING : Transistor connections and their characteristics: Common base connection- common emitter connection- common collector connection- transistor load line analysis-operating point- cut-off and saturation points- methods of transistor biasing: base resistor method- emitter bias circuit- biasing with collector feedback resistor- voltage divider bias method

Unit V FIELD EFFECT TRANSISTORS: Junction field effect transistor- principle and working of JFET- Difference between JFET and bipolar transistor- JFET as an amplifier- output characteristics of JFET- variation of transconductance of JFET- JFET biasing: bias battery- self-bias, potential divider, MOSFETs- E-MOSFET operation, D-MOSFET operation.

Text Books:

Mehta, V. K. Rohit Mehta, Principles of electronics, 11th ed., S. Chand & Co., New Delhi.

References:

1 Bell, D. A. Electronic devices and circuits, 4th ed., Prentice-Hall of India, New Delhi.
2. Malvino A., Bates, D. J. Electronic principles, 7th ed., Tata McGraw-hill publishing Co. Ltd., New Delhi.

Web Resources:

1. *https://www.electronics-tutorials.ws/dccircuits/dcp_9.html*
2. *https://www.dictionary.com/browse/semiconductor-diode*
3. http://uav.ece.nus.edu.sg/~bmchen/courses/EG1108_Rectifiers.pdf
4. *https://www.electronics-tutorials.ws/amplifier/transistor-biasing.html*
5. www.mhhe.com/engcs/electrical/neamen01/etext/ch05.pdf

Course Designers:

1. Dr.J.Suvetha Rani

Course Contents and lecture Schedule

	Topic	Lecture hrs.
1.1	Voltage source- constant voltage source- constant current source- conversion of voltage source into current source	4
1.2	maximum power transfer theorem- Thevenin's theorem- procedure for finding Thevinin equivalent circuit	4
1.3	Norton's theorem- Procedure for finding Norton equivalent circuit- Chassis and ground	4
2.1	PN junction- properties of PN junction- biasing a PN junction- current flow in a forward biased PN junction	4
2.2	Volt- Ampere characteristics of PN junction- Semiconductor diode- crystal diode as a rectifier-Resistance of crystal diode-	4
2.3	half wave rectifier- full –wave rectifiers-efficiency of HWR and FWR- bridge rectifier-efficiency-ripple factor	4
3.1	Filter circuits- Capacitor filter- choke input filter- capacitor input filter- voltage multipliers- half-wave voltage doubler	4
3.2	Zener diode- equivalent circuit of zener diode- zener diode as voltage stabilizer- clipping circuits- positive clipper- biased clipper-	4
3.3	combination clipper- Application of clippers- clamping circuits- Basic idea of a clamper- positive clamper- negative clamper	4
4.1	Transistor connections and their characteristics: Common base connection- common emitter connection- common collector connection	4
4.2	transistor load line analysis-operating point- cut-off and saturation points- methods of transistor biasing	4
4.3	base resistor method- emitter bias circuit- biasing with collector feedback resistor- voltage divider bias method	4
5.1	Junction field effect transistor- principle and working of JFET- Difference between JFET and bipolar transistor	4
5.2	JFET as an amplifier- output characteristics of JFET- variation of transconductance of JFET- JFET biasing:	4
5.3	bias battery- self-bias, potential divider, MOSFETs- E-MOSFET operation, D-MOSFET operation.	4

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	BASIC CIRCUIT ANALYSIS	12	Lecture
2	SEMICONDUCTOR DIODE	12	Lecture with PPT
3	FILTER CIRCUITS AND APPLICATIONS OF DIODES	12	Lecture with PPT
4	TRANSISTOR AND TRANSISTOR BIASING	12	Lecture with PPT
5	FIELD EFFECT TRANSISTORS	12	Lecture with PPT
Total		**60**	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19SE41A	INTRODUCTION TO NANOPHYSICS-I	SEC I	2	-	-	3

Year	Semester	Int. Marks	Ext.Marks	Total
Second	Fourth	15	35	50

Preamble

- Know the postulates and concepts of nanophysics with clarity.
- Understand the principles, fabrication and design of Carbon Nano-Tubes and their application.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Comprehend the theoretical and experimental aspects of quantum wells, wires and dots	K1, K2
CO2	Grasp the principles, fabrication and design of Carbon Nano-Tubes and their application	K1, K3

Mapping of COs with POs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	S	M	S
CO2	L	S	M	S	S

Blooms taxonomym

Bloom's category	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	30	30	65

Syllabus

INTRODUCTION TO NANOPHYSICS-I

Unit I GENERAL METHODS OF PREPARATIONS: Introduction – Emergence of Nanotechnology – Bottom-Up and Top-Down Approaches- Challenges in Nanotechnology-Self Assembled Minelayers: Introduction – monolayer on gold – growth process- phase transitions - patterning monolayer - mixed monolayer - SAMS and applications-Semiconductors Quantum Dots: Introduction – synthesis of

quantum dots – electronic structure of nano crystals – quantum dots-core relation of properties with size - uses.

Unit II CARBON NANOTUBES: Introduction - synthesis and purification – filling of nano tubes – mechanism of growth - electronic structure – transport properties – mechanical properties – physical properties – applications – nano tubes of other materials.

Text Books:

1. HuozhongGao, 2004. Nanostructures & Nanomaterials, Imperial College Press
2. Pradeep, T. 2007. NANO: The essentials – Undeerstanding Nanoscience and nano technology, Tata McGraw-Hill Publishing Company Ltd. New Delhi.

References:

1. Manasikarkare, 2008. Nanotechnology: Fundamentals and applications, I.K International Pvt.Ltd.

Web Resources:

1. .https://en.wikipedia.org/wiki/Quantum_dot
2. https://en.wikipedia.org/wiki/Carbon_nanotube

Course Designers:

1. Mrs.R.Dhanalakshmi

Course Contents and lecture Schedule

Unit	Topic	Lecture hrs.
1.1	Introduction – Emergence of Nanotechnology – Bottom-Up and Top-Down Approaches- Challenges in Nanotechnology	5
1.2	Self Assembled Minelayers: Introduction – monolayer on gold – growth process- phase transitions - patterning monolayer - mixed monolayer - SAMS and applications	5
1.3	Semiconductors Quantum Dots: Introduction – synthesis of quantum dots – electronic structure of nano crystals – quantum dots-core relation of properties with size - uses	5
2.1	Introduction - synthesis and purification – filling of nano tubes	5
2.2	mechanism of growth - electronic structure – transport properties – mechanical properties	5
2.3	physical properties – applications – nano tubes of other materials	5

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	GENERAL METHODS OF PREPARATIONS	15	Lecture with PPT
2	CARBON NANOTUBES	15	Lecture with PPT
Total			

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19SE41B	MEDICAL PHYSICS-I	SEC I	2			2

Year	Semester	Int. Marks	Ext.Marks	Total
Second	Fourth	15	35	50

Preamble

Physics plays an important role in the field of medical science. Handling simple devices such as thermometers, blood-pressure measuring apparatus, electro cardigogram, etc. to advanced medical equipment such as X-rays machines, ultrasound scanners, MRI and CT scanners, etc. need understanding of physics concepts behind them. This paper deals with the basic physics principles and their application in the field of Medicine.

Course Outcomes

#	Course Outcome	Knowledge Level
CO1	Understand the elementary concepts of blood pressure, the Physics of hearing and its application in hearing aid.	K2, K3
CO2	Explain the theory of transdurcers and their Bio-medical applications, Radiation therapy and Nuclear cardiogram.	K1, K3

Mapping of COs with POs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	M	X	L	M	S
CO2	S	M	L	M	S

Blooms taxonomy

Bloom's category	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total	30	30	65

Syllabus

MEDICAL PHYSICS-I

Unit I Thermal expansion: clinical thermometer – Thermostats – Use in Incubators – elementary idea of gas pressure – Blood pressure measuring apparatus – Physics of hearing – working of hearing aid – Effect of Infra & Ultra sound effect.

Unit II Transducers: definition –Transducers for Bio medical applications – Biological transducers – Bio medical transducers.- Doppler effect &Ultrasonics – Doppler Ultra sonography – Scanning – working of CT Scan – working of Betatron – Its medical applications –X – Rays – (Production & properties) – Soft & Hard X – Rays in medical diagnostics – Physiological consequences of nuclear radiations – Radiation therapy – Radiation diagnostics – Nuclear cardiogram.

Text Books:

1. How thinks work Vol. 1 & Vol. 2 :Harpens Collins Publ. India. A joint venture with The India Today Group, New Delhi (2002).
2. Roy R.N. 2001.A text book of bio physics ,Books and Allied (P) Ltd.
3. Arumugam M. Bio medical Instrumentation

References:

1. Brijlal&Subramaniam, 2002. Optics : S. Chand & Co
2. Venkatraman S.K. 2002. Biomedical electronics & Instrumentation, Galgotia Pub. Pvt. Ltd.
3. Leslie Cromwell, Fred.J.Weibell and Erich A, 2002. Bio medical Instrumentation & Measurements: Pfeiffer PHI.

Web Resources:

1. https://www.youtube.com/watch?v=1HH_v6F-gZU
2. https://en.wikipedia.org/wiki/Hearing_aid
3. https://en.wikipedia.org/wiki/Transducer
4. https://www.youtube.com/watch?v=l9swbAtRRbg
5. https://www.medicalnewstoday.com/articles/153201.php

Course Designers:

Mr.S.Alaguraja

Course Contents and lecture Schedule

Unit	Topic	
1.1	Thermal expansion – clinical thermometer – Thermostats – Use in Incubators	5
1.2	elementary idea of gas pressure – Blood pressure measuring apparatus	5
1.3	Physics of hearing – working of hearing aid – Effect of Infra & Ultra sound effect.	5
2.1	Transducers – definition –Transducers for Bio medical applications – Biological transducers – Bio medical transducers.- Doppler effect &Ultrasonics	5
2.2	Doppler Ultra sonography – Scanning – working of CT Scan – working of Betatron – Its medical applications –X – Rays – (Production & properties)	5
2.3	Soft & Hard X – Rays in medical diagnostics – Physiological consequences of nuclear radiations – Radiation therapy – Radiation diagnostics – Nuclear cardiogram.	5

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	Thermal expansion	15	Lecture with Practice
2	Transducers	15	Lecture with Practice
Total		30	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19SE41C	PHYSICS IN EVERYDAY LIFE	SEC I	2			2

Year	Semester	Int. Marks	Ext.Marks	Total
Second	Fourth	15	35	50

Preamble

- Know the Physics principles used in many frequently used appliances.
- Appreciate the physics principles that are used in media and communication systems.

Course Outcomes

#	Course Outcome	Knowledge Level
CO1	Acquire the knowledge of the Principles involved in various appliances viz., electric fan, air conditioner, Refrigerator, washing machine,etc. and their working in detail.	K2,k3
CO2	Comprehend the principles of devices/media used in communication systems	K1, k3

1.

Mapping of COs with POs

#	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	L	L	L	M
CO2	S	L	L	M	M

Blooms taxonomy

Bloom's Category	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	30	30	65

Syllabus

PHYSICS IN EVERYDAY LIFE

Unit I HOME APPLIANCES: Principle and working of electric lights, the electric fan, air cooler and air-conditioning unit - pressure cooker, refrigerator, washing machine, mixie, grinder, rice cooker, microwave oven.

Unit II COMMUNICATION SYSTEMS : Principles of telephone, cell phone, fax, internet, intranet and LAN - working of a Xerox machine and computer printers.-Principles involved in the working of the radio, TV, the remote control- principle and working of the tape recorder-CD player and the DVD player - microphones, amplifiers and loud speakers- the cinema.

Text Books:

1. Andrade, Physics for the Modern World, The English Language Book Society.
2. Sedov, E. Entertaining Electronics, University Publishers.
3. Leslie Cromwell, Biomedical Instrumentation and Measurements, Prentice Hall of India.

References:

1. IvarUtial, 101 Science Games, PustakMahal, Delhi .

Web Resources:

1. https://blog.schoolspecialty.com/physics-in-everyday-life-examples-for-the-classroom/
2. https://www.onlinecolleges.net/100-amazing-videos-for-teaching-and-studying-physics/
3. http://www.physics.org/explore.asp

Course Designers:

2. Dr.J.Suvetha Rani

Course Contents and lecture Schedule

	Topic	Lecture hrs.
1.1	Principle and working of electric lights, the electric fan, air cooler and air-conditioning unit	5
1.2	pressure cooker, refrigerator, washing machine	5
1.3	mixie, grinder, rice cooker, microwave oven.	5
2.1	Principles of telephone, cell phone, fax, internet, intranet and LAN - working of a Xerox machine and computer printers	5
2.2	Principles involved in the working of the radio, TV, the remote control- principle and working of the tape recorder	5
2.3	CD player and the DVD player - microphones, amplifiers and loud speakers- the cinema.	5

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	HOME APPLIANCES	15	Lecture with Practice
2	COMMUNICATION SYSTEMS	15	Lecture with Practice
Total		30	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19C51	ELEMENTARY SOLID STATE PHYSICS	Core 1	6			6

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Fifth	25	75	100

Preamble

- Know the fascinating subject of solid state physics.
- Understand the electronic structure of solids especially metals semiconductors and dielectrics.
- appreciate extensively on newer topics on superconductivity, dielectric and optical properties of materials

Course Outcomes

#	Course Outcome	Knowledge Level
CO1	Acquire the knowledge about the fundamentals of crystal physics, seven crystal systems and their symmetry in detail.	K1,K2
CO2	Understand the principles of X-ray diffraction and the methods available,various imperfections in crystals	K1,K3
CO3	Gain a complete idea about superconductors ,theories involved in superconductivity and its applications	K2, K3
CO4	Interpret the dielectric and ferroelectric materials, different types of electric polarization	K1, K2
CO5	Appreciate the novel optical materials, their applications in display devices, optical modulators.	K2, K3

Mapping of COs with POs

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

Blooms taxonomy

Bloom's category	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	52	52	140

Syllabus

ELEMENTARY SOLID STATE PHYSICS

Unit I CRYSTAL PHYSICS – I: Crystal Physics Lattice Points and Space Lattice – The Basis and Crystal Structure – Unit cells and Lattice parameters – Unit Cells versus Primitive cells – Crystal Systems – Crystal symmetry – Twenty three Symmetry elements in a Cubic Crystal – Fivefold rotation axis is not compatible with a Lattice – Combination of Symmetry elements – Rotation-Inversion axis – Translation symmetry Elements – Space Groups – The Bravais Space Lattices – Metallic Crystal Structures – Relation Between the Density of Crystal Material and Lattice constant in a Cubic Lattice.

Unit II CRYSTAL PHYSICS – II: Other Cubic Structures Directions, Planes and Miller Indices – Important Features of Miller indices of Crystal Planes – Important planes and Directions in a Cubic crystal – Distribution of Atoms in the Atomic Planes of a Simple Cubic Crystal – Separation Between Lattice planes in a Cubic crystal – Allotrophy and Polymorphism – Imperfections in Crystals – Reciprocal Lattice. Wave Nature of Matter and X-ray Diffraction The de Broglie Hypothesis – Relativistic Correction – experimental Study of Matter Waves – The Davisson-Germer Experiment – Heissenberg'sUncertainity Principle – X-ray Diffraction – Bragg's Law – Bragg's X-ray Spectrometer – Powder Crystal Method – Rotating Crystal Method – Correction for Bragg's Equation.

Unit III SUPERCONDUCTIVITY:A survey of superconductivity – Mechanism of super conductors – Effects of magnetic field A.C. Resistivity – Critical currents – Flux exclusion – The meissner effect – Thermal properties – The Energy Gap – Isotpe Effect – Mechanical Effects – The Penetration Depth – Type I and Type II Superconductors – London equations – Electrodynamics – superconductors in A.C. Fields – B.C.S. Theory – Josephson's Tunneling – Theory of D.C. Josephson Effect

Unit IV DIELECTRIC MATERIALS : Introduction- fundamental definitions in dielectrics- different types of electric polarization- frequency and temperature effects on polarization- dielectric loss- local field or internal field- Clausius- Mosotti relation- determination of dielectric constant- dielectric breakdown- properties and different types of insulating materials- ferroelectric materials

Unit V OPTICAL MATERIALS: Introduction- optical absorption in metals, semiconductors and insulators- Nonlinear optical materials and their applications- optical modulators- display devices and display materials- photoelectric electron emission- thermography and its materialS

Text Books:

1. Pillai, S.O. 1997, *Solid State Physics* 4th Ed., New Age International Publisher, (ISBN:81-224-1048-0).(Unit I : Pages 87 – 109; Unit II : Pages 110 -145, 157 – 170 ; Unit III : Pages 359 ,361 – 381 , 387 -389,392 -394)
2. Arumugam. M. 2002. *Materials Science* ,3rd Ed., Anuradha Agencies (Unit IV: Pages 6.1-6.42, Unit V: Pages 10.1-10.23, 10.36-10.70)

References:

1 Hannay, N.B. 1976. Solid State Chemistry, Prentice Hall of India Private Limited
2. Raghavan, V. 2003, Materials Science and Engineering – A First Course, 4th Ed., Prentice-Hall of India,(ISBN:81-203-1261-9)

Web Resources:

1. https://nptel.ac.in
2. https://podcasts.ox.ac.uk/series/oxford-solid-state-basics
3. http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html

Course Designers:

1. Mrs.R.Dhanalakshmi Mrs.R.Sribala

Course Contents and lecture Schedule

Unit	Topic	hrs.
1.1	Crystal Physics Lattice Points and Space Lattice – The Basis and Crystal Structure – Unit cells and Lattice parameters – Unit Cells versus Primitive cells – Crystal Systems – Crystal symmetry	5
1.2	Twenty three Symmetry elements in a Cubic Crystal – Fivefold rotation axis is not compatible with a Lattice – Combination of Symmetry elements – Rotation-Inversion axis – Translation symmetry Elements	5
1.3	Space Groups – The Bravais Space Lattices – Metallic Crystal Structures – Relation Between the Density of Crystal Material and Lattice constant in a Cubic Lattice.	5
2.1	Other Cubic Structures Directions, Planes and Miller Indices – Important Features of Miller indices of Crystal Planes – Important planes and Directions in a Cubic crystal – Distribution of Atoms in the Atomic Planes of a Simple Cubic Crystal	5
2.2	Separation Between Lattice planes in a Cubic crystal – Allotrophy and Polymorphism – Imperfections in Crystals – Reciprocal Lattice. Wave Nature of Matter and X-ray Diffraction The de Broglie Hypothesis – Relativistic Correction	5
2.3	experimental Study of Matter Waves – The Davisson-Germer Experiment – Heissenberg'sUncertainity Principle – X-ray Diffraction – Bragg's Law – Bragg's X-ray Spectrometer – Powder Crystal Method – Rotating Crystal Method – Correction for Bragg's Equation.	5
3.1	A survey of superconductivity – Mechanism of super conductors – Effects of magnetic field A.C. Resistivity – Critical currents	5
3.2	Flux exclusion – The meissner effect – Thermal properties – The Energy Gap – Isotpe Effect – Mechanical Effects – The Penetration Depth	5
3.3	Type I and Type II Superconductors – London equations – Electrodynamics – superconductors in A.C. Fields – B.C.S. Theory – Josephson's Tunneling – Theory of D.C. Josephson Effect	5
4.1	Introduction- fundamental definitions in dielectrics- different types of electric polarization- frequency and temperature effects on polarizatio	5
4.2	dielectric loss- local field or internal field- Clausius- Mosotti relation-determination of dielectric constant	5
4.3	dielectric breakdown- properties and different types of insulating materials-ferroelectric materials	5
5.1	Introduction- optical absorption in metals, semiconductors and insulators-	5
5.2	Nonlinear optical materials and their applications- optical modulators-	5
5.3	display devices and display materials- photoelectric electron emission-thermography and its materials	5

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	CRYSTAL PHYSICS – I	12	Lecture with PPT
2	CRYSTAL PHYSICS – II	12	Lecture with PPT
3	SUPERCONDUCTIVITY	12	Lecture with PPT
4	DIELECTRIC MATERIALS	12	Lecture with PPT
5	OPTICAL MATERIALS	12	Lecture with PPT
Total		60	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19C52	ANALOG ELECTRONICS	Core -10	6		-	6

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Fifth	25	75	100

Preamble

- Acquire knowledge and apply it to various electronics instruments.
- Apply the development of the electronic instruments.
- Motivate the students to apply the principles of electronics in their day – to – day life

Course Outcomes

#	Course Outcome	Knowledge Level
CO1	Study the characteristics of transistor amplifiers	K1
CO2	Discern the fundamental aspects of Power Amplifiers	K1, K2
CO3	Design the different types of oscillators using transistors	K2, K3
CO4	Recognize the basic concepts of modulation and demodulation	K1, K3
CO5	Understand the basic concepts and applications of OP-AMP	K1, K3

Mapping of COs with POs

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

Blooms taxonomy

Bloom's category	Continuous Assessment Tests		Terminal Examination
	I	II	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	52	52	140

Syllabus

ANALOG ELECTRONICS

Unit I: TRANSISTOR VOLTAGE AMPLIFIERS : Single stage amplifier-graphical demonstration-practical circuit-phase reversal-DC & AC equivalent circuits-load line analysis-voltage gain- input impedance of CE amplifier- classification of amplifiers-multistage transistor amplifier-important terms - RC, transformer and direct coupled amplifiers.

Unit II: TRANSISTOR AUDIO POWER AMPLIFIERS : Transistor audio power amplifier-small signal and large signal amplifiers-difference between voltage and power amplifiers-performance quantities and classification of power amplifiers-expression for collector efficiency-maximum collector efficiency of series-fed class A amplifier-thermal runaway- heat sink-push-pull amplifier.

Unit III: OSCILLATORS : Sinusoidal oscillator- types of sinusoidal oscillators-oscillatory circuit-positive feedback-amplifier-essentials of transistor oscillator-explanation of Barkhausen criterion - tuned collector, Colpitt's, Hartley, phase shift and Wien-bridge oscillators.

Unit IV: MODULATION AND DEMODULATION : Modulation-types of modulation-amplitude modulation-modulation factor- sideband frequencies in AM wave- transistor AM modulator-limitations of amplitude modulation-frequency modulation-theory of FM-comparison of FM and AM-demodulation.

Unit V:APPLICATIONS OF OP-AMPS : Inverting amplifier-noninverting amplifier-voltage follower-summing amplifiers-applications of summing amplifiers:as averaging amplifier, as subtractor-op-amp integrator-critical frequency of integrators-op-amp differentiator-comparator circuits: as a square wave generator, zero-crossing detector and a level detector.

Text Books:

1. Mehta, V. K. Mehta, R.Principles of electronics, 11th ed., S. Chand & Co., New Delhi.

References:

1. Bell, D. A. Electronic devices and circuits, 4th ed., Prentice-Hall of India, New Delhi.
2. Malvino,A. Bates, D. J. Electronic principles, 7th ed., Tata McGraw-hill publishing Co. Ltd., New Delhi.
3. Chattopadhyay, D..Rakshit, P. C.Electronics Fundamentals and applications, 12th ed., New Age International(P) Limited, New Delhi.

Web Resources:

1. https://www.electronics-tutorials.ws/amplifier/amp_2.html
2. https://en.wikipedia.org/wiki/Audio_power_amplifier
3. https://en.wikipedia.org/wiki/Electronic_oscillator
4. https://www.electronics-tutorials.ws/opamp/opamp_1.html
5. https://byjus.com › Physics › Physics Article

Course Designers:

1. Dr.G.Arivazhagan
2. Dr.R.Srinivasan

Course Contents and lecture Schedule

Unit	Topic	Lecture hrs.
1.1	Single stage amplifier-graphical demonstration-practical circuit-phase reversal-DC & AC equivalent circuits	4
1.2	load line analysis-voltage gain- input impedance of CE amplifier-	4

	classification of amplifiers	
1.3	multistage transistor amplifier-important terms - RC, transformer and direct coupled amplifiers.	4
2.1	Transistor audio power amplifier-small signal and large signal amplifiers-difference between voltage and power amplifiers	4
2.2	performance quantities and classification of power amplifiers-expression for collector efficiency	4
2.3	maximum collector efficiency of series-fed class A amplifier-thermal runaway- heat sink-push-pull amplifier	4
3.1	Sinusoidal oscillator- types of sinusoidal oscillators-oscillatory circuit-positive feedback	4
3.2	amplifier-essentials of transistor oscillator-explanation of Barkhausen criterion	4
3.3	tuned collector, Colpitt's, Hartley, phase shift and Wien-bridge oscillators.	4
4.1	Modulation-types of modulation-amplitude modulation-modulation factor	4
4.2	sideband frequencies in AM wave- transistor AM modulator-limitations of amplitude modulation	4
4.3	frequency modulation-theory of FM-comparison of FM and AM-demodulation	4
5.1	Inverting amplifier-noninverting amplifier-voltage follower-summing amplifiers-	4
5.2	applications of summing amplifiers :as averaging amplifier, as subtractor-op-amp integrator-critical frequency of integrators	4
5.3	Op-Amp differentiator-comparator circuits: as a square wave generator, zero-crossing detector and a level detector.	4

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	TRANSISTOR VOLTAGE AMPLIFIERS	12	Lecture with Demo
2	TRANSISTOR AUDIO POWER AMPLIFIERS	12	Lecture with PPT
3	OSCILLATORS	12	Lecture with PPT
4	MODULATION AND DEMODULATION	12	Lecture with PPT
5	APPLICATIONS OF OP-AMPS	12	Lecture with PPT
Total		60	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19C53	MODERN PHYSICS	Core 1	6			6

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Fifth	25	75	100

Preamble

Evolution of various areas of Physics since the beginning of the 20th century which revolutionized our understanding of matter at atomic scale and universe may be classified as Modern Physics. This course deals with the physical principles underlying topics of Modern Physics such as relativity, astrophysics and cosmology.

Course Outcomes

#	Course Outcome	Knowledge Level
CO1	Summarise the significance of the postulates of special and general relativity	K1
CO2	Explain the significant experimental observations which validated postulates of special and general relativity.	K1
CO3	Illustrate the consequences of accelerating reference frames (inertial) moving at relativistic velocities.	K2
CO2	Solve problems related to consequences of inertial and non-inertial frames of references moving at relativistic velocities with respect to each other	K2
CO4	Evaluate the physical principles and their mathematical basis in the evolution of stars during its various stages.	K3
CO5	Assess the role of principles of modern physics and its impact in setting up new benchmarks in understanding the origin and evolution of our Universe.	K3

Title of the course

MODERN PHYSICS

Unit I RELATIVITY – I The experimental basis of relativity: Michelson-Morley experiment – Einstein's postulates – The Lorentz transformation: Calibrating the space-time axes – Time dilation – Length contraction – The Doppler Effect.

Unit II RELATIVITY – II The twin paradox and ther consequences – Relativistic momentum – Relativistic energy – Mass/Energy conversion and binding energy – Invariant mass

Unit III GENERAL RELATIVITY General relativity – Deflection of light in a gravitational field – Gravitational red shift – Perhelion of Mercury's orbit – Delay of light in a gravitational field.

Unit IV ASTROPHYSICS The Sun : Is there life elsewhere? – The Stars : The celestial sphere – The evolution of stars – Cataclysmic Events – Final states of stars.

Unit V COSMOLOGY Cosmology and Gravitation – Cosmology and the Evolution of the Universe: "Natural" Planck units

Text Books:

1. Tipler, P.A. &Lewellyn, R.A., 2012. Modern Physics , 6th ed., W.H Freeman & Co.,
   Unit I – p.3-55 Unit II – p.65-97 Unit III – p.97-112 Unit IV – p.639-673 Unit V – p.673-696

References:

1. Thornton, S.T. & Rex, A., 2006. Modern Physics for Scientists and Engineers ,4th ed., Cengage Learning,
2. Serway, R.A., Moses, C.J. & Moyer, C.A., 2005. Modern Physics , 3rd ed., Thomson Learning Inc., [ISBN 0-534-40624-6]
3. Beiser, A., 2003.Concepts of Modern Physics , 6th ed., McGraw Hill
4. Krane, K.S. 2011. Modern Physics, 3rd ed., John Wiley & Sons

Web Resources:

1. https://nptel.ac.in
2. https://faraday.physics.utoronto.ca/GeneralInterest/Harrison/Flash/
3. http://www.soulphysics.org/2008/06/get-started-learning-general-relativity/
4. https://www.refsmmat.com/jsphys/relativity/relativity.html

Course Designers:

1. Dr. R.V.Krishnakumar
2. Mrs.V.RajniSwamy

Mapping of COs with POs

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

Blooms taxonomy

Bloom's category	**CA**		**End of Semester**
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	52	52	140

Course Contents and lecture Schedule

Unit	Topic	Lecture hrs.
1.1	The experimental basis of relativity: Michelson-Morley experiment – Einstein's postulates	7
1.2	The Lorentz transformation: Calibrating the space-time axes	6
1.3	Time dilation – Length contraction – The Doppler Effect.	5
2.1	The twin paradox and their consequences	5
2.2	Relativistic momentum – Relativistic energy	5
2.3	Mass/Energy conversion and binding energy – Invariant mass	5
3.1	General relativity – Deflection of light in a gravitational field	6
3.2	Gravitational red shift – Perhelion of Mercury's orbit	5
3.3	Delay of light in a gravitational field.	5
4.1	The Sun : Is there life elsewhere?	5
4.2	The Stars : The celestial sphere	5
4.3	The evolution of stars – Cataclysmic Events – Final states of stars	5
5.1	Cosmology and Gravitation	5
5.2	Cosmology and the Evolution of the Universe: "Natural" Planck units	5

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	RELATIVITY – I	18	Lecture with Demo
2	RELATIVITY – II	15	Lecture with PPT
3	GENERAL RELATIVITY	16	Lecture with PPT
4	ASTROPHYSICS	15	Lecture with PPT
5	COSMOLOGY	10	Lecture with PPT
	Total	60	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19CE51A	NUMERICAL METHODS WITH PROGRAMMING IN C	Elective	4		-	4

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Fifth	25	75	100

Preamble

- Basic mathematical methods which are required for Physics problems are introduced.
- Enable the students to write programmes using C.
- Apply the Programming in C to solve problems in numerical methods.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Comprehend the use of numerical methods in solving physics problems	K2,K3
CO2	Realize the various methods in numerical integration	K2
CO3	Recognize the basic concepts of C language	K1
CO4	Hear and relate the basic concepts of C language	K1, K3
CO5	Learn the role of functions, arrays, pointers and programming structures of C	K1,K3

Mapping of COs with POs

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

Blooms taxonomy

Bloom's category	Continuous Assessment Tests		Terminal Examination
	I	II	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

Syllabus

NUMERICAL METHODS WITH PROGRAMMING IN C

Unit I: Algebraic and Transcendental Equations : Introduction – Iteration method – Bisection method – Regula-falsi method – Newton-Raphson method.

Unit II: Numerical Differentiation and Numerical Integration : Derivatives using Newton's forward difference formula – Derivatives using Newton's backward difference formula - Derivatives using Newton's central difference formula – Numerical Integration – Trapezoidal rule – Simpson's one third rule.

Unit III: C Fundamentals : Identifiers and keywords – Data types – Constants – Variables – Declarations – Expressions – Symbolic constants – Library functions

Operators and Expressions: Arithmetic operators – Unary operators – Relational and Logical operator – Assignment operator – Conditional operator and Bitwise operator

Data input and output : The get char functions – the put char function – Scanf function – Printf function – Gets and puts function.

Unit IV: Control Statements :Branching statement: The if and if-else statement – The while statement and the do-while statement

Looping statement : The for statement – Nested control statement – the switch statement – The break statement – The continue statement – The goto statement.

Unit V: Arrays, Functions and Structures : Arrays – one dimensional, two dimensional & multidimensional arrays – Defining a function – Accessing a function – function prototypes – passing Arguments to a function – Recursion – Structures – Initialization – comparison – Arrays of structures – Arrays within structures – structures within structures.

Text Books:

1. Arumugam Isaac, Numerical Analysis with Programming in C, New Gamma publications, India

References:

1. Brian W. Kernnigham and Dennis M. Ritchi, The C programming language, 2nd Ed. Prentice-Hall of India Pvt. Ltd.
2. Henry Mullish and Herbert L Cooper, The spirit of C, 15th Ed, Jaico Publishing house.
3. Kuo, 1966. Numerical methods and Computers: Addison Wesley, London,
4. Rajaraman, Computer Oriented Numerical Methods , 3rd Ed, Prentice Hall, New Delhi.

Web Resources:

1. *https://en.wikipedia.org/wiki/Numerical_method*
2. https://en.wikipedia.org/wiki/Numerical_methods_for_ordinary_differential_equations
3. www.kciti.edu/wp-content/uploads/2017/07/cprogramming_tutorial.pdf

Course Designers:

1. Mrs.R.Dhanalakshmi
2. Dr.J.Suvetha Rani

Course Contents and lecture Schedule

Unit	Topic	Lecture hrs.
1.1	Introduction – Iteration method	4
1.2	Bisection method – Regula-falsi method	4
1.3	Newton-Raphson method.	4
2.1	Derivatives using Newton's forward difference formula	4
2.2	Derivatives using Newton's backward difference formula - Derivatives using Newton's central difference formula	4
2.3	Numerical Integration – Trapezoidal rule – Simpson's one third rule.	4
3.1	Identifiers and keywords – Data types – Constants – Variables – Declarations – Expressions – Symbolic constants – Library functions	4
3.2	Arithmetic operators – Unary operators – Relational and Logical operator – Assignment operator – Conditional operator and Bitwise operator	4
3.3	The get char functions – the put char function – Scanf function – Printf function – Gets and puts function.	4
4.1	The if and if-else statement – The while statement and the do-while statement	4
4.2	The for statement – Nested control statement – the switch statement	4
4.3	The break statement – The continue statement – The goto statement.	4
5.1	Arrays – one dimensional, two dimensional & multidimensional arrays – Defining a function – Accessing a function	4
5.2	function prototypes – passing Arguments to a function – Recursion – Structures – Initialization	4
5.3	comparison – Arrays of structures – Arrays within structures – structures within structures.	4

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	Algebraic and Transcendental Equations	18	Lecture with Practice
2	Numerical Differentiation and Numerical Integration	15	Lecture with PPT
3	C Fundamentals	16	Lecture with demo
4	Control Statements	15	Lecture with Practice
5	Arrays, Functions and Structures	10	Lecture with Practice
Total		60	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19CE51B	MATHEMATICAL PHYSICS	Major Elective	4			4

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Fifth	25	75	100

Preamble

Mathematics is indispensable to physics as every physical situation has a mathematical basis. The course deals with application of mathematical methods to solve problems in physics. Though mathematical physics is a broad subject, this course covers some of the essential areas such as vectors, matrices, tensors, complex analysis and Fourier series.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Describe the mathematical basis of vectors and their application in physics problems.	K1
CO2	Explain the concept of eigenvectors and eigenvalues and their physical meaning.	K1
CO3	Demonstrate the application of tensors in physics	K2
CO4	Comprehend the theorems of complex analysis.	K1
CO5	Describe the usefulness of Fourier series in solving problems associated with periodicity.	K3

Mapping of COs with POs

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

Blooms taxonomy

Bloom's category	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	52	52	140

Syllabus

MATHEMATICAL PHYSICS

Unit I VECTOR ALGEBRA: Introduction- simple applications of vectors to mechanics-The scalar and vector fields- directional derivatives- level surfaces- the gradient of a scalar field- the divergence of a vector point function- the curl or rotation of a vector point function- The line integral- Gauss divergence theorem

Unit II SPECIAL MATRICES: Introduction to matrices- Square , diagonal and constant matrices-real, symmetric and hermitian matrices-normal matrix- triangular matrix- the inverse matrix- inverse transformation- orthogonal matrix- unitary matrix and their transformations- cramer's rule- Eigen values -Eigen vectors; Diagonalizing a matrix

Unit III TENSORS: Introduction- occurance of tensors in physics- Notation and conventions- contravariant vector- covariant vector- tensors of second rank- equality and null tensor- addition and subtraction- outer product and inner product of tensors- the metric tensor-contravariant metric tensor-associate tensor

Unit IV COMPLEX VARIABLES: Introduction- definitions- operation of fundamental laws of algebra on complex numbers- Regular functions- Cachy's theorem- Cauchy's integral formula- Cauchy's residue theorem

Unit V FOURIER SERIES AND INTEGRALS: Fourier series- Dirichlet's theorem- Complex form of Fourier series- Uses of Fourier series- Physical examples of Fourier series-Fourier integral

Text Books:

1. Gupta, B.D . 1993. Mathematical Physics, II Ed., Vikas Publishing House.(ISBN:0-7069-76-4).
2. Joshi, A.W. Matrices and tesnors in Physics, New age international publishers (ISBN:81-224-0563-0)

References:

1. Satyaprakash, Mathermatical physics with classical mechanics, Sultan chand& sons (ISBN 81-7014-925-8)

Web Resources:

Course Designers:

1. Mr.M.Venkatachalam
2. Dr.J.Suvetha Rani

Course Contents and lecture Schedule

Unit	Topic	Lecture hrs.
1.1	Introduction- simple applications of vectors to mechanics-The scalar and vector fields- directional derivatives- level surfaces-	4
1.2	the gradient of a scalar field- the divergence of a vector point function- the curl or rotation of a vector point function-	4
1.3	The line integral- Gauss divergence theorem	4
2.1	Introduction to matrices- Square , diagonal and constant matrices-real, symmetric and hermitian matrices	4
2.2	-normal matrix- triangular matrix- the inverse matrix- inverse transformation	4
2.3	orthogonal matrix- unitary matrix and their transformations- cramer's rule- Eigen values -Eigen vectors; Diagonalizing a matrix	4
3.1	Introduction- occurance of tensors in physics- Notation and conventions- contravariant vector- covariant vector	4
3.2	tensors of second rank- equality and null tensor- addition and subtraction- outer product and inner product of tensors	4
3.3	the metric tensor-contravariant metric tensor- associate tensor	4
4.1	Introduction- definitions- operation of fundamental laws of algebra on complex numbers	4
4.2	Regular functions- Cachy's theorem	4
4.3	Cauchy's integral formula- Cauchy's residue theorem	4
5.1	Fourier series- Dirichlet's theorem	4
5.2	Complex form of Fourier series- Uses of Fourier series	4
5.3	Physical examples of Fourier series-Fourier integral	4

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	VECTOR ALGEBRA	18	Lecture with Practice
2	SPECIAL MATRICES	15	Lecture with PPT
3	TENSORS	16	Lecture with demo
4	COMPLEX VARIABLES	15	Lecture with Practice
5	FOURIER SERIES AND INTEGRALS	10	Lecture with Practice
	Total	60	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19CE51C	INTRODUCTION TO MICROPROCESSOR- 8085	Major Elective	4			4

Preamble

- Understand the architecture of 8085 microprocessor
- Write the programs using instruction sets
- Understand the interrupts and interfacing of 8085 microprocessor

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Realize the designing of the microprocessor architecture µP 8085	K1
CO2	Get the basic knowledge on address bus, data bus, Opcodes and operands	K2
CO3	Learn the interfacing and timing diagrams of µP 8085	K3
CO4	Gain Knowledge with PPI	K3
CO5	Apply the knowledge of µP 8085 in implementing interrupts	K3

Mapping of COs with POs

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

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

Syllabus

INTRODUCTION TO MICROPROCESSOR- 8085

Unit I ARCHITECTURE OF 8085: Architecture of 8085 microprocessor, registers, flags, ALU-Address bus and data bus - Demultiplexing address / data bus-Control and status signals-Control bus - Programmers model of 8085-Pin-out signal function diagram-Functions of different pins.

Unit II INSTRUCTION SET: Instruction set of 8085-data transfer, arithmetic, logic, branching and machine control group of instructions-Addressing modes-register, register indirect, direct, immediate and implied addressing modes. Assembly language and machine language-Programming exercises-addition, subtraction, multiplication and division (all 8-bit binary), ascending order/descending order.

Unit III INTERFACING-I: Memory interface - Interfacing 2Kx8 ROM and RAM interface -Timing diagram of 8085 instructions (MOV Rd, Rs - MVI data8)

Unit IV INTERFACING-II: Interfacing input port and output port to 8085 - Programmable peripheral interface 8255 - flashing LEDs.

Unit V INTERRUPTS: Interrupts in 8085 - hardware and software interrupts RIM, SIM instructions - priorities. Simpie-polled and interrupt controlled data transfer.

Text Books:

1. Ramesh Gaonkar, Wiley Easteni, Microprocessor Architecture Programming and Application with 8085/ 8080A
2. Vijayendran V. Viswanathan S. Fundamentals of Microprocessor 8085

References:

1. AdityaMathur, Introduction to Microprocessors
2. Lance A. Levanthal, Introduction to Microprocessors

Web Resources:

Course Designers:

1. Mr.M.Venkatachalam

Course Contents and lecture Schedule

Unit	Topic	Lecture hrs.
1.1	Architecture of 8085 microprocessor, registers, flags, ALU	4
1.2	Address bus and data bus - Demultiplexing address / data bus-Control and status signals-Control bus -	4
1.3	Programmers model of 8085-Pin-out signal function diagram-Functions of different pins.	4
2.1	Instruction set of 8085-data transfer, arithmetic, logic, branching and machine control group of instructions-Addressing modes	4

2.2	register, register indirect, direct, immediate and implied addressing modes.	4
2.3	Assembly language and machine language-Programming exercises-addition, subtraction, multiplication and division (all 8-bit binary), ascending order/descending order.	4
3.1	Memory interface - Interfacing 2Kx8	4
3.2	ROM and RAM interface	4
3.3	Timing diagram of 8085 instructions (MOV Rd, Rs - MVI data8)	4
4.1	Interfacing input port and output port to 8085	4
4.2	Programmable peripheral interface 8255	4
4.3	flashing LEDs	4
5.1	Interrupts in 8085	4
5.2	hardware and software interrupts RIM, SIM instructions- priorities	4
5.3	Simpie-polled and interrupt controlled data transfer	4

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	ARCHITECTURE OF 8085	12	Lecture with Practice
2	INSTRUCTION SET	12	Lecture with PPT
3	INTERFACING-I	12	Lecture with demo
4	INTERFACING-II	12	Lecture with Practice
5	INTERRUPTS	12	Lecture with Practice
Total		60	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19NE51	NON CONVENTIONAL ENERGY	Non- Major Elective II	2			2

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Fifth	15	35	50

Preamble

- Explain the available Bio and Wind Energy sources
- Understand the working various Bio and Wind Energy devices

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Learn basic concepts of biomass energy conversion and working principles of different bio-gas plants	K1, K2
CO2	Learn basic concepts of wind energy conversion and principles of different wind energy conversion systems.	K1, K2

Mapping of COs with POs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	L	M	S
CO2	M	S	S	L	S

Blooms taxonomy

Bloom's Category	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	30	30	65

Syllabus

NON CONVENTIONAL ENERGY

Unit I BIO-MASS ENERGY Biomass conversion Technologies – Biogas generation – Classification of bio-gas plant- Types- KVIC, Janta and Deena bandhu model biogas plant- Gasification of Biomass – Gasifier – Construction and operation of down draught and up draught gasifier – Application of Gasifiers

Unit II WIND ENERGY The nature of wind- Wind energy conversion- Basic Components of Wind Energy conversion Systems (WECS) - Classification of Wind Energy conversion Systems – Advantage and Disadvantage of WECS- Energy Storage- Application of Wind Energy.

Text Books:

1. Rai, G.D. 2011, Non-Conventional Energy Sources, Reprint, Khanna Publishers, New Delhi.

References:

1. Sukhatme S.P. Solar Energy Principles thermal collection and storage, 1984, Tata McGraw Hill publications

Course Designers:

1. Dr.S.Rajakarthihan

Course Contents and lecture Schedule

Unit	Topic	Lecture hrs.
1.1	Biomass conversion Technologies – Biogas generation – Classification of bio-gas plant-	4
1.2	Types- KVIC, Janta and Deena bandhu model biogas plant- Gasification of Biomass – Gasifier –	5
1.3	Construction and operation of down draught and up draught gasifier – Application of Gasifiers	6
2.1	The nature of wind- Wind energy conversion- Basic Components of Wind Energy conversion Systems (WECS) -	7
2.2	Classification of Wind Energy conversion Systems – Advantage and Disadvantage of WECS-	4
2.3	Energy Storage- Application of Wind Energy.	4

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	BIO-MASS ENERGY	15	Lecture with PPT
2	WIND ENERGY	15	Lecture with PPT
Total		30	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19C61	ATOMIC AND MOLECULAR SPECTROSCOPY	Core 1	6			6

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Sixth	25	75	100

Preamble

Spectroscopy is the study of interaction of matter with electromagnetic radiation and constitutes an important area of Physics. This paper deals with the underlying principles of spectroscopic methods such as electronic, vibrational, rotational, nuclear magnetic resonance and Raman spectroscopy.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Describe the evolution of atom models and the introduction of relativistic effects in explaining the fine structure of spectral lines of hydrogen atoms	K1
CO2	Apply Pauli's exclusion principle to interpret the electronic configuration of atoms	K2
CO3	Illustrate the splitting of spectral lines under the influence of magnetic and electric fields	K2
CO4	Explain the classification of molecular spectra.	K3
CO5	Summarise the underlying principles of Raman scattering, NMR, ESR an Mossbauer spectroscopy.	K3

Mapping of COs with POs

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

Blooms taxonomy

Bloom's Category	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	52	52	140

Syllabus

ATOMIC AND MOLECULAR SPECTRA

Unit I ATOMIC MODELS Early atomic spectra – Thomson model – Alpha particle scattering – Rutherford's nuclear model – Bohr's model of the Hydrogen atom – The Hydrogen spectrum – Bohr's model-correction for nuclear motion – Hydrogen-like atom – General quantization rule – Sommerfeld's model – The correspondence principle – Deficiencies of the quantum theory

Unit II ATOMIC SPECTRA – I Hydrogen atom spectrum – Orbital magnetic moment of hydrogen atom – Larmor precession –Stern-Gerlach experiment – Electron spin – The vector atom model – Spin-orbit and fine structure – Pauli's exclusion principle and electronic configuration. Total angular momentum in many electron systems: L-S coupling or RusselSaunder's coupling – j-j coupling – Hund's rules.

Unit III ATOMIC SPECTRA – II Energy levels and transitions of Helium – Alkali spectra : Shielding by core electrons – Spectral terms of equivalent electrons – Normal Zeeman effect : Early experimental arrangement – Theory – Anomalous Zeeman effect – Paschen-Bach effect – Stark effect – Moseley's law – Width of spectral lines.

Unit IV MOLECULAR SPECTRA – I Electromagnetic spectrum – Molecular energies – Classification of molecules –Rotational spectra of diatomic molecules – Diatomic vibrational spectra – Rotation-vibration transitions – Vibrations of polyatomic molecules – Characteristic group frequencies – Infrared spectrometer – Electronic spectra – Frank-Condon principle.

Unit V MOLECULAR SPECTRA – II Raman scattering : Quantum theory of Raman scattering – Classical description of Raman scattering – Vibrational Raman scattering – Rotational Raman spectra – Raman spectrometer – Nuclear Magnetic Resonance : NMR principle – The NMR spectrometer – Chemical shifts – Indirect spin-spin interaction – Applications of NMR – Electron Spin Resonance : ESR Priniple – ESR spectrometer – Hyperfine interaction – Applications of ESR spectroscopy – Mossbauer Spectroscopy : Principle – Isomer shift

Text Books:

1. Aruldhas G. Rajagopal P. 2005. Modern Physics, 7th print, PHI Learning Private Limited, Delhi [ISBN 978-81-203-2597-5]
Unit I – Chapter 3, Secs.3.1 – 3.12 Unit II – Chapter 7, Secs.7.1-7.9 Unit III – Chapter 7, Secs.7.10 – 7.19 Unit IV – Chapter 9, Secs.9.1 – 9.11 Unit V – Chapter 9, Secs.9.12 – 9.15

References:

1. Graybeal, J.D. :*Molecular spectroscopy*, McGraw-Hill, New York, 1988.
2. Hollas, M: *Modern spectroscopy*, 4th ed., John Wiley, New York, 2004.

Web Resources:

http://hyperphysics.phy-astr.gsu.edu/hbase/hframe.html

Course Designers:

1. Dr. R.V.Krishnakumar
2. Mrs.V.RajniSwamy

Course Contents and lecture Schedule

Unit	Topic	Lecture hrs.
1.1	Early atomic spectra – Thomson model – Alpha particle scattering – Rutherford's nuclear model	4
1.2	Bohr's model of the Hydrogen atom – The Hydrogen spectrum –Bohr's model-correction for nuclear motion – Hydrogen-like atom	4
1.3	General quantization rule – Sommerfeld's model – The correspondence principle – Deficiencies of the quantum theory	4
2.1	Hydrogen atom spectrum – Orbital magnetic moment of hydrogen atom – Larmor precession –Stern-Gerlach experiment	4
2.2	Electron spin – The vector atom model – Spin-orbit and fine structure – Pauli's exclusion principle and electronic configuration.	4
2.3	Total angular momentum in many electron systems: L-S coupling or RusselSaunder's coupling – j-j coupling – Hund's rules.	4
3.1	Energy levels and transitions of Helium – Alkali spectra: Shielding by core electrons – Spectral terms of equivalent electrons.	4
3.2	Normal Zeeman effect : Early experimental arrangement – Theory – Anomalous Zeeman effect	4
3.3	Paschen-Bach effect – Stark effect – Moseley's law – Width of spectral lines	4
4.1	Electromagnetic spectrum – Molecular energies – Classification of molecules –Rotational spectra of diatomic molecules	4
4.2	Diatomic vibrational spectra – Rotation-vibration transitions – Vibrations of polyatomic molecules	4
4.3	Characteristic group frequencies – Infrared spectrometer – Electronic spectra – Frank-Condon principle.	4
5.1	Raman scattering : Quantum theory of Raman scattering – Classical description of Raman scattering – Vibrational Raman scattering – Rotational Raman spectra – Raman spectrometer	4
5.2	Nuclear Magnetic Resonance : NMR principle – The NMR spectrometer – Chemical shifts – Indirect spin-spin interaction – Applications of NMR	4
5.3	Electron Spin Resonance : ESR Priniple – ESR spectrometer – Hyperfine interaction – Applications of ESR spectroscopy – Mossbauer Spectroscopy : Principle – Isomer shift	4

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	ATOMIC MODELS	12	Lecture with Practice
2	ATOMIC SPECTRA – I	12	Lecture with PPT
3	ATOMIC SPECTRA – II	12	Lecture with demo
4	MOLECULAR SPECTRA – I	12	Lecture with Practice
5	MOLECULAR SPECTRA – II	12	Lecture with Practice
Total		60	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19C62	NUCLEAR AND PARTICLE PHYSICS	Core 1	6			6

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Sixth	25	75	100

Preamble

Nuclear and particle physics deals with the characteristic features of atomic nuclei, the properties nucleons, radioactive decay, the nature of interaction between elementary particles of the standard model. This course deals with the concepts of nuclear properties, radioactive decay, nuclear reactions and underlying principles of nature and interaction between elementary particles.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Explain the characteristic properties of nuclei, nuclear decay, nuclear reactions	K1
CO2	Summarise the various nuclear models and their successes and failures.	K2
CO3	Classify the various types of particle accelerators and detectors	K2
CO4	Distinguish between the characteristic features of fundamental particles.	K3
CO5	Assess the magnitude and impact of energy produced in nuclear reactors.	K3

Mapping of COs with POs

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

Blooms taxonomy

Bloom's Category	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	52	52	140

Syllabus

NUCLEAR AND PARTICLE PHYSICS

Unit I NUCLEAR PROPERTIES: Constituent of nuclei – Nuclear size – Mass spectrometer – Binding energy – Angular momentum of the nucleus – Magnetic moment – Nuclear quadrupole moment – Parity – Semi-emperical mass formula – Existence of magic numbers – Nuclear shell model – Predictions of the Shell model – Nuclear forces – Two nuclear system (Deuteron) – General features – Meson theory of nuclear forces.

Unit II RADIOACTIVE DECAY: Discovery of radioactivity – Rate of decay, half-life and mean life – Conservation laws in radioactive decays – Decay series – Radioactive equilibrium – Secular equilibrium – Transient equilibrium – Radioactive dating – Alpha decay – Theory of Alpha decay – Beta decay – Electron emission – Positron emission – Electron capture – Theory of beta decay – Gamma decay – Radioisotopes – Applications.

Unit III NUCLEAR REACTIONS: Nuclear reactions – Basics – Cross-section – Nuclear reaction kinetics – Q value of a nuclear reaction – Reaction mechanisms – The compound nucleus – Neutron activation – Direct reactions – Nuclear fission – Theory of nuclear fission – Chain reaction – Fission reactor – Breeder reactor – Nuclear fusion – Fusion reaction in stars – Fusion reactor – Transuranium elements

Unit IV NUCLEAR RADIATION DETECTORS AND PARTICLE ACCELERATORS: Ionization chamber and Geiger counter – Geiger-Muller counter – Scintillation counter – Semiconductor junction detector – The cloud chamber – The bubble chamber – Other detectors : Spark chamber – Photographic emulsion – Cerenkov detector – Cyclotron – Synchrocyclotron – Synchrotron – Synchrotron radiation – Linear accelerator

Unit V ELEMENTARY PARTICLES: Fundamental interactions in nature – Dawn of elementary particle physics – Mediator of an interaction – pi-mesons – Muons, Kaons and Hyperons – Particles and antiparticles – Classification of elementary particles – Conservation laws – Lepton conservation – Baryon conservation – Strangeness – Isospin – Hypercharge.

Text Books:

1. Aruldhas , G. Rajagopal, .P. 2005. Modern Physics, 7th print, PHI Learning Private Limited, Delhi. [ISBN 978-81-203-2597-5]

Unit I – Chapter 17, Secs.17.1 – 17.13 Unit II – Chapter 18, Secs.18.1 – 18.10 Unit III – Chapter 19, Secs.19.1 – 19.7 Unit IV – Chapter 20, Secs.20.1 – 20.9 Unit V – Chapter 21, Secs.21.1 – 21.5

References:

1. Thornton, S.T. & Rex, A., 2006. Modern Physics for Scientists and Engineers, 4th ed., Cengage Learning.
2. Tipler, P.A &Llwellyn, R.A. 2008. Modern Physics , 5th ed., W.H. Freeman & Co., New York,
3. Serway, R.A., Moses, C.J. & Moyer, C.A., 2005. Modern Physics ,3rd ed., Thomson Learning Inc., [ISBN 0-534-40624-6]
4. Beiser, A., 2003.Concepts of Modern Physics , 6th ed., McGraw Hill.
5. Krane, K.S. 2011. Modern Physics , 3rd ed., John Wiley & Sons,

Web Resources:

Course Designers:

1. Dr. R.V.Krishnakumar 2. Mrs.V.RajniSwamy

Course Contents and lecture Schedule

Unit	Topic	Lecture hrs.
1.1	Constituent of nuclei – Nuclear size – Mass spectrometer – Binding energy	4
1.2	Angular momentum of the nucleus – Magnetic moment – Nuclear quadrupole moment – Parity – Semi-emperical mass formula – Existence of magic numbers	4
1.3	Nuclear shell model – Predictions of the Shell model – Nuclear forces – Two nuclear system (Deuteron) – General features – Meson theory of nuclear forces.	4
2.1	Discovery of radioactivity – Rate of decay, half-life and mean life – Conservation laws in radioactive decays – Decay series	4
2.2	Radioactive equilibrium – Secular equilibrium – Transient equilibrium – Radioactive dating – Alpha decay – Theory of Alpha decay	4
2.3	Beta decay – Electron emission – Positron emission – Electron capture – Theory of beta decay – Gamma decay – Radioisotopes – Applications	4
3.1	Nuclear reactions – Basics – Cross-section – Nuclear reaction kinetics – Q value of a nuclear reaction – Reaction mechanisms	4
3.2	The compound nucleus – Neutron activation – Direct reactions – Nuclear fission – Theory of nuclear fission	4
3.3	Chain reaction – Fission reactor – Breeder reactor – Nuclear fusion – Fusion reaction in stars – Fusion reactor – Transuranium elements	4
4.1	Ionization chamber and Geiger counter – Geiger-Muller counter – Scintillation counter – Semiconductor junction detector	4
4.2	The cloud chamber – The bubble chamber – Other detectors : Spark chamber – Photographic emulsion	4
4.3	Cerenkov detector – Cyclotron – Synchrocyclotron – Synchrotron – Synchrotron radiation – Linear accelerator	4
5.1	Fundamental interactions in nature – Dawn of elementary particle physics – Mediator of an interaction	4
5.2	pi-mesons – Muons, Kaons and Hyperons – Particles and antiparticles – Classification of elementary particles	4
5.3	Conservation laws – Lepton conservation – Baryon conservation – Strangeness – Isospin – Hypercharge.	4

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	NUCLEAR PROPERTIES	12	Lecture with Practice
2	RADIOACTIVE DECAY	12	Lecture with PPT
3	NUCLEAR REACTIONS	12	Lecture with demo
4	NUCLEAR RADIATION DETECTORS AND PARTICLE ACCELERATORS	12	Lecture with Practice
5	ELEMENTARY PARTICLES	12	Lecture with Practice
Total		60	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19C63	DIGITAL ELECTRONICS	Core 1	6			6

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Sixth	25	75	100

Preamble

- Able to understand different number systems, logic gates and Boolean algebra
- Know combinational and sequential logic systems
- Give an insight to the students about fundamental concepts, techniques and applications of Flip-flops and Counters

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Understand the binary number systems	K1
CO2	Apply the basics binary arithmetic and solve the problems	K1
CO3	Devise the flip flops	K2, K3
CO4	Design the registers and counters using digital logic circuits	K3
CO5	Make a distinction between A/D and D/A converters	K3

Mapping of COs with POs

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

Blooms taxonomy

Bloom's Category	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	52	52	140

Syllabus

DIGITAL ELECTRONICS

Unit I DIGITAL PRINCIPLES & DIGITAL LOGIC : Definition of Digital Signals – Digital Wave forms – Digital Logic – Moving & Storing – Digital Information – Digital operation- Digital Components – Digital ICs – Digital IC signal levels - Binary – Basic Gates – Boolean Algebra – Gates with bubbles – Positive & Negative Logic.

Unit II COMBINATIONAL LOGIC CIRCUIT & DATA PROCESSING CIRCUIT: Boolean Laws – Sum Of Products – Truth Table to Karnaugh Map - Karnaugh Map Simplification – Product Of Sum – Multiplexer – Decoder – Encoder – XOR Gates – Parity Generator – ROM - PAL – PLA – Trouble Shooting.

Unit III FLIP FLOPS, CLOCKS & TIMERS: RS Flip Flop – Edge Triggered RS, D, JK Flip Flops – Flip Flop Timing – JK Master Slave – Switch Contact Bouncing Circuit – Clock Wave forms – TTL Clock – Schmidt Trigger – Circuits using 555 timer – Pulse forming Circuits.

Unit IV REGISTERS & COUNTERS : Types of Registers – SISO – SIPO – PISO – PIPO – Ring Counter – Various types of Counters - Asynchronous, Synchronous, MOD – 5, Presettable, & Shift Counters – MOD 10 shift counter – Digital Clock.

Unit V ARITHMETIC CIRCUITS, D/A & A/D CONVERSION: Binary Addition – Subtraction – Unsigned Binary Numbers – 2's compliment – Arithmetic building block – Adder – Subtractor – Binary Multiplication & Division – Variables Resistor Networks – Binary Ladder – DAC – ADC – AD technique – Dual Slope – AD Accuracy & Resolution.

Text Books:

1. Donald P. Leech , Albert Paul Malvino, Digital Principles and Applications, 5th Ed., Tata-McGraw-Hill.

References:

1. Donald P. Leach, Experiments in Digital Principles , III Edition, Tata McGraw Hill.
2. Flyod, Digital Fundamentals , Universal Books Stall, New Delhi.

Web Resources:

1. *info.iet.unipi.it/~luigi/biomedica/sito/cosc205.pdf*
2. *https://www.electronics-tutorials.ws/combination/comb_1.html*
3. https://www.ssucet.org/~jgallaher/.../Chapter9-LatchesFlip-FlopsAndTimers.pdf
4. *https://en.wikibooks.org/wiki/Digital_Circuits/Registers_and_Counters*
5. *examradar.com/ad-and-da-converters*

Course Designers:

1. Dr.G.Arivazhagan
2. Dr.R.Srinivasan

Course Contents and lecture Schedule

Unit	Topic	Lecture hrs.
1.1	Definition of Digital Signals – Digital Wave forms – Digital Logic – Moving & Storing – Digital Information	4
1.2	– Digital operation- Digital Components – Digital ICs – Digital IC signal levels – Binary	4
1.3	Basic Gates – Boolean Algebra – Gates with bubbles – Positive & Negative Logic.	4
2.1	Boolean Laws – Sum Of Products – Truth Table to Karnaugh Map	4
2.2	Karnaugh Map Simplification – Product Of Sum – Multiplexer	4
2.3	Decoder – Encoder – XOR Gates – Parity Generator – ROM - PAL – PLA – Trouble Shooting.	4
3.1	RS Flip Flop – Edge Triggered RS, D, JK Flip Flops – Flip Flop Timing	4
3.2	JK Master Slave – Switch Contact Bouncing Circuit – Clock Wave forms	4
3.3	TTL Clock – Schmidt Trigger – Circuits using 555 timer – Pulse forming Circuits.	4
4.1	Types of Registers – SISO – SIPO – PISO – PIPO	4
4.2	Ring Counter – Various types of Counters - Asynchronous, Synchronous,	4
4.3	MOD – 5, Presettable, & Shift Counters – MOD 10 shift counter – Digital Clock.	4
5.1	Binary Addition – Subtraction – Unsigned Binary Numbers – 2's compliment	4
5.2	Arithmetic building block – Adder – Subtractor – Binary Multiplication & Division	4
5.3	– Variables Resistor Networks – Binary Ladder – DAC – ADC – AD technique – Dual Slope – AD Accuracy & Resolution.	4

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	DIGITAL PRINCIPLES & DIGITAL LOGIC	12	Lecture with PPT
2	COMBINATIONAL LOGIC CIRCUIT & DATA PROCESSING CIRCUIT	12	Lecture with PPT
3	FLIP FLOPS, CLOCKS & TIMERS	12	Lecture with PPT
4	REGISTERS & COUNTERS	12	Lecture with PPT
5	ARITHMETIC CIRCUITS, D/A & A/D CONVERSION	12	Lecture with PPT
Total		60	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19CE61A	INTRODUCTION TO QUANTUM MECHANICS	Major Elective	6			6

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Sixth	25	75	100

Preamble

- Know the basic concepts of Quantum mechanics
- Compare and contrast Newton's classical mechanics and Planck's QM
- Illustrate Heissenberg`s Uncertainty principle by thought experiments.
- Apply the Schrodinger wave equation in various physical problems.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Distinguish classical and quantum physics concepts, origin of quantum theory in detail.	K1,K2
CO2	Understand the concept of wave velocity,Group velocity and the consequences of de Broglie`s hypothesis for matter waves.	K1,K2
CO3	Learn about Heissenberg`s Uncertainty principle by thought experiments.	K1, K3
CO4	Derive Schrodinger wave equation in one and three dimensions and know about the postulates of quantum mechanics	K2, K3
CO5	Apply Schrodinger wave equation for harmonic oscillator and particle in a box	K1, K3

Mapping of COs with POs

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

Blooms taxonomy

Bloom's Category	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	52	52	140

Syllabus

INTRODUCTION TO QUANTUM MECHANICS

Unit I ORIGIN OF QUANTUM THEORY: Black body radiation-Failure of classical physics to explain energy distribution in the spectrum of a black body – Planck`s quantum theory – Photoelectric effect – Einstein`s explanation of the photoelectric effect – The Ritz combination principle in spectra – Stability of an atom – Bohr`s quantization of angular momentum and its application to the hydrogen atom.

Unit II WAVE PROPERTIES OF MATTER: Wave particle duality – de Broglie hypothesis for matter waves – concept of wave velocity –Concept of Group velocity – Velocity of de Broglie wave – diffraction of particles – Interference of electrons – Consequences of de Broglie`s concepts –wave packet.

**Unit III HEISSENBERG`S UNCERTAINTY PRINCIPLE:**Uncertainty principle – Elementary proof of Heisenberg`s uncertainty relation - Elementary proof of uncertainty relation between energy and time – Illustration of Heisenberg`s uncertainty principle by thought – Experiments – Consequences of uncertainty relation.

**Unit IV SCHRODINGER`S WAVE EQUATION:**Schrodinger`s one dimensional time dependent wave equation- one dimensional time independent Schrodinger`s wave equation – Physical interpretation of the wave function □ - Operators in quantum mechanics, Eigen function , Eigen value and Eigen value equation – Expectation values – Postulates of quantum mechanics – transition probability.

Unit V APPLICATIONS OF QUANTUM MECHANICS : Particle in a one dimensional box – Particle in a rectangular three dimensional box – Simple Harmonic Oscillator – Reflection at a step potential – Transmission across a potential barrier: the Tunnel effect.

Text Books:

1. Kamal Singh , S.P. Singh**:** S. 2005. Elements of Quantum Mechanics, S. Chand & Company, New Delhi [ISBN:81 -219-2539-8]

UNIT I Chapter 1 [Sec. 1.1 – 1.8] UNIT II Chapter 2 [Sec. 2.1 – 2.9] UNIT III Chapter 3 [Sec. 3.1 – 3.5] UNIT IV Chapter 4 [Sec. 4.1 – 4.7] UNIT V Chapter 5 [Sec.5.1 – 5.5]**.**

References:

1. Aruldhas, G. 2002. Quantum Mechanics, Prentice – Hall of India, [ISBN81- 203-1962. 667]

Web Resources:

Course Designers:

1. Mrs.V.RajniSwamy
2. Mrs.R.Sribala

Course Contents and lecture Schedule

Unit	Topic	Lecture hrs.
1.1	Black body radiation-Failure of classical physics to explain energy distribution in the spectrum of a black body – Planck`s quantum theory	5
1.2	Photoelectric effect – Einstein`s explanation of the photoelectric effect – The Ritz combination principle in spectra	5
1.3	Stability of an atom – Bohr`s quantization of angular momentum and its application to the hydrogen atom.	5
2.1	Wave particle duality – de Broglie hypothesis for matter waves – concept of wave velocity	5
2.2	Concept of Group velocity – Velocity of de Broglie wave –diffraction of particles	5
2.3	Interference of electrons – Consequences of de Broglie`s concepts –wave packet	5
3.1	Uncertainty principle – Elementary proof of Heisenberg`s uncertainty relation	5
3.2	Elementary proof of uncertainty relation between energy and time – Illustration of Heisenberg`s uncertainty principle by thought	5
3.3	Experiments – Consequences of uncertainty relation.	5
4.1	Schrodinger`s one dimensional time dependent wave equation- one dimensional time independent Schrodinger`s wave equation	5
4.2	Physical interpretation of the wave function □ - Operators in quantum mechanics, Eigen function	5
4.3	Eigen value and Eigen value equation – Expectation values – Postulates of quantum mechanics – transition probability.	5
5.1	Particle in a one dimensional box – Particle in a rectangular three dimensional box	5
5.2	Simple Harmonic Oscillator – Reflection at a step potential	5
5.3	Transmission across a potential barrier: the Tunnel effect.	5

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	ORIGIN OF QUANTUM THEORY	12	Lecture with PPT
2	WAVE PROPERTIES OF MATTER	12	Lecture with PPT
3	HEISSENBERG`S UNCERTAINTY PRINCIPLE	12	Lecture with PPT
4	SCHRODINGER`S WAVE EQUATION	12	Lecture with PPT
5	APPLICATIONS OF QUANTUM MECHANICS	12	Lecture with PPT
Total		60	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19CE61B	OPTICAL FIBER COMMUNICATION SYSTEMS	Major Elective	6			6

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Sixth	25	75	100

Preamble

- Know the role played by optical fibers in conquering distance and time.
- Understand the various classifications of optical fibres and the losses encountered while sending signals.
- Elaborate the various sources, detectors and the fibre optic sensors used

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Impart knowledge on the introduction to optical fibre	K1
CO2	Understand the classification and fibre loss	K1, K2
CO3	Appreciate the applications of optical fibre	K2, K3
CO4	Compare the optical properties with the electrical properties	
CO5	Classify the types optical fibers	

Mapping of COs with POs

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

Blooms taxonomy

Bloom's Category	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	52	52	140

Syllabus

OPTICAL FIBER COMMUNICATION SYSTEMS

Unit I INTRODUCTION TO OPTICAL FIBRES: What are optical fibres? –Importance-Generation of telephone system and optical fibre-Propagation of light in different media-Propagation of light in an optical fibre-Basic structure and optical path of an optcalfibre-Acceptance angle and acceptance cone-Numerical aperture(NA)-Modes of propagation-Meridional and skew rays-Number of modes and cutoff parameters of fibres-Single mode propagation-Comparison of step and graded index fibres-Application of fibres.

Unit II CLASSIFICATION OF OPTICAL FIBRES: Fibres-Classification of stepped index fibre-Stepped index monomodefibre-Disadvantages of monomodefibre-Graded index monomodefibre-Plastic fibres-Other latest developed types of fibres-Mechanism of refractive index variation-Fibre strength-Mechanical strength measurement of optical fibres.

Unit III FIBRE LOSSES: Attenuation in optic fibres-Material or impurity losses-Rayleigh scattering losses- Absorption losses-Leaky modes-Bending losses-Radiation induced losses-Inherent defect losses-Inverse square law losses-Transmission losses-Temperature dependence of fibre losses-Core and cladding losses.

Unit IV DISPERSION IN OPTICAL FIBRES: Electrical vs optical bandwidth-Bandwidth length product-Dispersion in an optical fibre- Intermodal dispersion-Mixing of modes-Material chromatic dispersion-Waveguide dispersion-Dispersion power penalty-Total dispersion delay-Maximum transmission rate- Dispersion shifted fibres

Unit V OPTICAL FIBRE SOURCES, DETECTORS AND TYPES OF FIBRE OPTIC SENSORS : SOURCES: Introduction-LED-Laser-Light emitting transistor-Organic LEDs-Power efficiency-OLED: structure and operation-Quantum efficiency. **PHOTODETECTORS:** Introduction-Characteristic of photo-detectors-Photoemissive photo-detectors- Photoconductive devices-Photo voltaic devices-PN junction photo-detector-Pin photodiode- Avalanche photo diode-Photo transistor-bit error rate(BER). **SENSORS:**Introduction-Fibre optic sensors-Intensity modulated sensors-Liquid level type hybrid sensor-Diffraction grating sensors-Sensors using single mode fibre-Interferometric sensor-Polarisation problem in interferometric sensor using SMF-Medical applications of fibre sensors-Fibre optic gyroscopes-Vibrations and displacement measurement sensors-Rotary position sensor-Linear position measuring sensor-Liquid level sensor-Acceleration measuring sensor-Multiplexing and distributed sensing.

Text Books:

1. Subir Kumar Sarkar, Optical fibres and fibre optic communication systems. S.chand&company Ltd.(ISBN:81-219-1459-0)

References:

1. John Crisp, Introduction to fibre optics, II edition (ISBN: 07506-50303)
2. Gerd Keiser, Optical fibre communication, III edition, McGraw Hill Co. (ISBN: 07-232101- 6)

Web Resources:

1. *www.jb.man.ac.uk/research/fibre/intro2fibre.htm*
2. *science.jrank.org/pages/2702/Fiber-Optics-Fiber-classifications.html*
3. https://en.wikipedia.org/wiki/Fiber_optic_sensor

Course Designers:

1. Mrs.V.RajniSwamy 2. Mrs.R.Sribala

Course Contents and lecture Schedule

Unit	Topic	hrs.
1.1	What are optical fibres? –Importance-Generation of telephone system and optical fibre-Propagation of light in different media-Propagation of light in an optical fibre	3
1.2	Basic structure and optical path of an optcalfibre-Acceptance angle and acceptance cone- Numerical aperture(NA)-Modes of propagation	3
1.3	Meridional and skew rays-Number of modes and cutoff parameters of fibres-Single mode propagation-Comparison of step and graded index fibres-Application of fibres.	3
2.1	Fibres-Classification of stepped index fibre-Stepped index monomodefibre-Disadvantages of monomodefibre	4
2.2	Graded index monomodefibre-Plastic fibres-Other latest developed types of fibres-Mechanism of refractive index variation	4
2.3	Fibre strength-Mechanical strength measurement of optical fibres.	4
3.1	Attenuation in optic fibres-Material or impurity losses-Rayleigh scattering losses-Absorption losses	4
3.2	Leaky modes-Bending losses-Radiation induced losses-Inherent defect losses-Inverse square law losses	4
3.3	Transmission losses-Temperature dependence of fibre losses-Core and cladding losses.	4
4.1	Electrical vs optical bandwidth-Bandwidth length product-Dispersion in an optical fibre- Intermodal dispersion	3
4.2	Mixing of modes-Material chromatic dispersion-Waveguide dispersion-Dispersion power penalty	3
4.3	Total dispersion delay-Maximum transmission rate- Dispersion shifted fibres	3
5.1	Introduction-LED-Laser-Light emitting transistor-Organic LEDs-Power efficiency-OLED: structure and operation-Quantum efficiency-Introduction-Characteristic of photo-detectors-Photoemissive photo-detectors- Photoconductive devices-Photo voltaic devices	6
5.2	PN junction photo-detector-Pin photodiode- Avalanche photo diode-Photo transistor-bit error rate(BER)- Introduction-Fibre optic sensors-Intensity modulated sensors-Liquid level type hybrid sensor-Diffraction grating sensors-Sensors using single mode fibre-Interferometric sensor- Polarisation problem in interferometric sensor using SMF	6
5.3	Medical applications of fibre sensors-Fibre optic gyroscopes-Vibrations and displacement measurement sensors-Rotary position sensor-Linear position measuring sensor-Liquid level sensor-Acceleration measuring sensor-Multiplexing and distributed sensing.	6

Lecture Schedule

Unit	Topic	hrs.	Method
1	INTRODUCTION TO OPTICAL FIBRES	9	Lecture with Demo
2	CLASSIFICATION OF OPTICAL FIBRES	12	Lecture with PPT
3	FIBRE LOSSES	12	Lecture with PPT
4	DISPERSION IN OPTICAL FIBRES	9	Lecture with PPT
5	OPTICAL FIBRE SOURCES, DETECTORS AND TYPES OF FIBRE OPTIC SENSORS	18	Lecture with PPT
Total		60	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19CE61C	ELECTROMAGNETISM	Major Elective	6			6

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Sixth	25	75	100

Preamble

- Know the basics of electromagnetic theory
- Understand the motion of charged particle in electric and magnetic fields
- Understand the fundamental principles of magneto statics

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Know the basics of electromagnetic theory	K1
CO2	Understand the motion of charged particle in electric and magnetic fields	K2, K3
CO3	Realize the effect of Electromagnetic induction	K2, K3
CO4	Familiar with Maxwell's Equations and Electromagnetic waves	K1, K2
CO5	Make out fundamental principles of magneto statics	K2, K3

Mapping of COs with POs

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

Blooms taxonomy

Bloom's Category	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	52	52	140

Syllabus

ELECTROMAGNETISM

Unit I MAGNETIC EFFECT OF ELECTRIC CURRENT: Introduction- The Biot-Savert law- Magnetic induction at a point due to a straight conductor carrying current- Magnetic induction at a point on the axis of a circular coil carrying current- Magnetic induction at a point on the axis of a solenoid

Unit II FORCE ON CURRENT BY MAGNETIC FIELD: Force on a current carrying conductor in a magnetic field- Force between two parallel current carrying conductors- Force experienced by an electron moving in a magnetic field- Moving coil Ballistic galvanometer- current and voltage sensitivities of a moving coil galvanometer- Uses of Ballistic galvanometer

Unit III ELECTROMAGNETIC INDUCTION: Faraday's laws of Electromagnetic induction- Faraday's law of electromagnetic induction in vector form- self- induction- self inductance of a long solenoid- Determination of self inductance by Rayleigh's method- Determination of self- inductance by Anderson's bridge method- Mutual induction- Mutual inductance between two coaxial solenoids- Experimental determination of mutual inductance- coefficient of coupling- Earth inductor- Eddy currents- uses of eddy currents

Unit IV MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVES : Introduction- Displacement current- Maxwell's equations in material media- Plane Electromagnetic waves in free space: Velocity of light- Poynting vector-Hertz experiment for production and detection of electromagnetic wave-Motion of charged particle in uniform electric field(Longitudinal)- Motion of charged particle in uniform electric field(Transverse)- Motion of charged particle in alternating electric field- Motion of charged particle in uniform constant magnetic field- Motion of charged particle in crossed electric and magnetic fields

Unit V MAGNETOSTATICS: Magnetic vector potential – Magnetic field for a long straight current carrying wire – magnetic scalar potential – application of magnetic scalar potential: Equivalence of a small current loop and a magnetic dipole – Electric field vector in terms of scalar and vector potentials – Magnetic shell – Potential at any point due to a magnetic shell – Magnetic potential and field at a point on the axis of a flat circular magnetic shell – Equivalence of magnetic shell and current circuit – The Hall effect.

Text Books:

1. Murugeshan, R. 2011.*Electricity and Magnetism*,,Nineth revised edition., S.Chand& Company Ltd, New Delhi [ISBN:81-219-1705-0]

References:

1. Reitz, J.R., Milford, F.J & Christy, R.W. 1998. Foundations of electromagnetic theory III ed., Narosa Publishing House, ISBN 81-85015-79-1.
2. Chopra, K. K. Agarwal, G. C. 2010. Electromagnetic theory, V ed., K. Nath& Co.
3. David J. 2000. Griffiths. Introduction to Electrodynamics, III ed., Prentice Hall of India, ISBN 81-203-1601-0.

Course Designers:

1. Mrs.V.RajniSwamy
2. Mrs.R.Dhanalakshmi

Course Contents and lecture Schedule

Unit	Topic	hrs.
1.1	Introduction- The Biot-Savert law- Magnetic induction at a point due to a straight conductor carrying current-	5
1.2	Magnetic induction at a point on the axis of a circular coil carrying current-	5
1.3	Magnetic induction at a point on the axis of a solenoid	5
2.1	Force on a current carrying conductor in a magnetic field- Force between two parallel current carrying conductors	5
2.2	Force experienced by an electron moving in a magnetic field- Moving coil Ballistic galvanometer	5
2.3	current and voltage sensitivities of a moving coil galvanometer- Uses of Ballistic galvanometer	5
3.1	Faraday's laws of Electromagnetic induction- Faraday's law of electromagnetic induction in vector form- self- induction	5
3.2	self inductance of a long solenoid- Determination of self inductance by Rayleigh's method- Determination of self- inductance by Anderson's bridge method	5
3.3	Mutual induction- Mutual inductance between two coaxial solenoids- Experimental determination of mutual inductance- coefficient of coupling- Earth inductor- Eddy currents- uses of eddy currents	5
4.1	Introduction- Displacement current- Maxwell's equations in material media- Plane Electromagnetic waves in free space: Velocity of light- Poynting vector	5
4.2	Hertz experiment for production and detection of electromagnetic wave-Motion of charged particle in uniform electric field(Longitudinal)	5
4.3	Motion of charged particle in uniform electric field(Transverse)- Motion of charged particle in alternating electric field- Motion of charged particle in uniform constant magnetic field- Motion of charged particle in crossed electric and magnetic fields	5
5.1	Magnetic vector potential – Magnetic field for a long straight current carrying wire – magnetic scalar potential – application of magnetic scalar potential: Equivalence of a small current loop and a magnetic dipole	5
5.2	– Electric field vector in terms of scalar and vector potentials – Magnetic shell – Potential at any point due to a magnetic shell	5
5.3	Magnetic potential and field at a point on the axis of a flat circular magnetic shell – Equivalence of magnetic shell and current circuit – The Hall effect.	5

Lecture Schedule

Unit	Topic	hrs.	Method
1	MAGNETIC EFFECT OF ELECTRIC CURRENT	12	Lecture with PPT
2	FORCE ON CURRENT BY MAGNETIC FIELD	12	Lecture with PPT
3	ELECTROMAGNETIC INDUCTION	12	Lecture with PPT
4	MAXWELL'S EQUATIONS AND ELECTROMAGNETIC WAVES	12	Lecture with PPT
5	MAGNETOSTATICS	12	Lecture with PPT
Total		60	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19SE61A	PRACTICAL ELECTRIC CIRCUITS	SEC II	2			2

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Sixth	15	35	50

Preamble

- Gain knowledge on house wiring.
- Apply the knowledge to rectify simple electrical problems faced at home.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Learn the concepts and applications of heating and chemical effects of current.	K1, K2
CO2	Understand the concepts behind house wiring.	K1, K2

Mapping of COs with POs

	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	M	X	M	M
CO2	S	L	L	M	S

Blooms taxonomy

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**30**	**30**	**65**

Syllabus

PRACTICAL ELECTRIC CIRCUITS

Unit I BASIC PRINCIPLES: Heating effect of current(qualitatively) – Joule's law – heaters and flat iron – automatic temperature control(thermostat) – chemical effect of current (qualitatively) – electrolysis – Faraday's law – electroplating.

Unit II HOUSE WIRING: Single phase and three phase electrical power supply – delta, star and T connection – house wiring – switch board wiring – fan regulator connection – stair case switch connection fuse fixing – to attend to faults in a tube light circuit – to attend to flat iron connection(simple and automatic) – eliminator testing – multimeter – tester usage – lighting arrestor.

Text Books:

1. How things Work Vol 1 &Vol 2: 2002,Harper Collins Publ. India a joint venture with The India Today Group, N. Delhi.

References:

1. Brijlal&Subramaniam, 2002. Electricity &Magnetism ,S. Chand & Co.
2. Theraja, 2002. Electrical technology, S. Chand & Co.

Web Resources:

Course Designers:

1. Mr.S.Alaguraja

Course Contents and lecture Schedule

Unit	Topic	Lecture hrs.
1.1	Heating effect of current(qualitatively) – Joule's law	2
1.2	Heaters and flat iron – automotic temperature control(thermostat)	7
1.3	chemical effect of current (qualitatively) – electrolysis – Faraday's law – electroplating	6
2.1	Single phase and three phase electrical power supply – delta, star and T connection – house wiring – switch board wiring	6
2.2	fan regulator connection – stair case switch connection fuse fixing – to attend to faults in a tube light circuit	5
2.3	to attend to flat iron connection(simple and automatic) – eliminator testing – multimeter – tester usage – lighting arrestor.	4

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	BASIC PRINCIPLES	15	Lecture with PPT
2	HOUSE WIRING	15	Lecture with Demo & Practice
Total		30	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19SE61B	INTRODUCTION TO NANOPHYSICS-II	SEC II	2			2

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Sixth	15	35	100

Preamble

- Know the general characterization of nano materials
- Understand the nano sensors and their applications

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Learn different characterization techniques of nanomaterials and the working principle of instruments used for characterization.	K1, K2
CO2	Learn different sensors working at nanoscale and Physics behind them.	K1, K2

Mapping of COs with POs

#	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	L	M	M	S
CO2	M	X	L	M	S

Blooms taxonomy

Bloom's Category	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	30	30	65

Syllabus

INTRODUCTION TO NANOPHYSICS-II

Unit I GENERAL CHARACTERIZATION: Experimental methods: Investigating and manipulating materials in nanoscales – introduction - electron microscopes - scanning probe microscopes - optical microscopes for nano science and technology – other kinds of microscopes – XRD - associated techniques.

Unit II NANO SENSORS: Introductions - nano sensors - order from chaos - nano scale organization for sensors – characterization – perception - nano sensors based on optical properties - nano sensors based on quantum size effects - electrochemical sensors- sensors based on physical properties - nano biosensors - smart dust.

Text Books:

1. HuozhongGao, 2004. Nanostructures & Nanomaterials, Imperial College Press.
2. Pradeep, T. 2007.NANO: The essentials – Undeerstanding Nanoscience and nano technology, Tata McGraw-Hill Pubhilisng Company Ltd. New Delhi.

References:

1. Manasikarkare, 2008. Nanotechnology: Fundamentals and applications, I.K International Pvt.Ltd.

Web Resources:

Course Designers:

1. Mrs.R.Dhanalakshmi

Course Contents and lecture Schedule

Unit	Topic	Lecture
1.1	Experimental methods: Investigating and manipulating materials in nanoscales	4
1.2	introduction - electron microscopes - scanning probe microscopes - optical microscopes for nano science and technology - other kinds of microscopes –	8
1.3	XRD - associated techniques.	3
2.1	Introductions - nano sensors - order from chaos	3
2.2	nano scale organization for sensors – characterization – perception - nano sensors based on optical properties - nano sensors based on quantum size effects	7
2.3	Electrochemical sensors- sensors based on physical properties - nano biosensors - smart dust.	5

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	GENERAL CHARACTERIZATION	15	Lecture with Demo and PPT
2	NANO SENSORS	15	Lecture with PPT
Total		30	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19SE61C	MEDICAL PHYSICS-II	SEC II	2			2

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Sixth	15	35	100

Preamble

- Understand the working of various medical instruments
- Gain practical knowledge on various instruments
- Get awareness about the banes and boons of nuclear radiation.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Identify the types of lenses, various eye defects and practical knowledge about medical instruments like EEG, MRI and ECG.	K1, K3
CO2	Aware of the biological effects of radiation, radiation hazards occurring in man, atmosphere and space.	K1, K2

Mapping of COs with POs

#	PSO1	PSO2	PSO3	PSO4	PSO5
CO1	S	S	M	M	M
CO2	S	S	L	L	M

Blooms taxonomy

Bloom's Category	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	30	30	65

Syllabus

MEDICAL PHYSICS-II

Unit I MEDICAL INSTRUMENTS Types of lenses – Focal length – Combination of lenses – Power (Diopter) of a lens - Defects in eye – Intraocular pressure measureument – Glaucoma – Correction of defects

using lenses – Sensing & Tracing of electric pulses – EEG & ECG – NMR – magnetic resonance imaging – MRI scanning Instrument – Working of heart and lung machine – Artificial kidney .

Unit II RADIATION Effect of UV, visible & IR radiations on human body – IR lamp & IR therapy – Biological effect of radiation – Radiation damage in embryo and fetus during pregnancy – demerits of different diagnostic and theraptic methods of nuclear medicine during pregnancy – Radiation hazards in man – radiation hazards in atmosphere and space.

Text Books:

1. Brijlal&Subramaniam, 2002. Optics, S. Chand &Co , New Delhi.
2. Venkatraman. S.K. 2002. Bio medical electronics ,Galgotia Pub. Instrumentation Pvt. Ltd,

References:

1. How things work Vol. 1 & Vol. 2 : 2002. Harpens Collins Publ. India. A joint venture with The India Today Group, New Delhi .
2. Roy R.N. 2001. A text book of bio physics : Books and Allied (P) Ltd.
3. Arumugam M. Bio medical Instrumentation
4. Leslie Cromwell, Fred.J.Weibell, Erich A. 2002. Bio medical Instrumentation and Measurements, Pfeiffer PHI .

Web Resources:

1. https://www.youtube.com/watch?v=Av1ZiN9P01s
2. http://hyperphysics.phy-astr.gsu.edu/hbase/vision/eyedef.html
3. https://en.wikipedia.org/wiki/Magnetic_resonance_imaging
4. http://hyperphysics.phy-astr.gsu.edu/hbase/mod3.html

Course Designers:

1. Mr.S.Alaguraja

Course Contents and lecture Schedule

Unit	Topic	hrs.
1.1	Types of lenses – Focal length – Combination of lenses – Power (Diopter) of a lens - Defects in eye – Intraocular pressure measureum	5
1.2	Glaucoma – Correction of defects using lenses – Sensing & Tracing of electric pulses – EEG & ECG	5
1.3	NMR – magnetic resonance imaging – MRI scanning Instrument – Working of heart and lung machine – Artificial kidney .	5
2.1	Effect of UV, visible & IR radiations on human body – IR lamp & IR therapy – Biological effect of radiation – Radiation damage in embryo and fetus during pregnancy	5
2.2	demerits of different diagnostic and theraptic methods of nuclear medicine during pregnancy	5
2.3	Radiation hazards in man – radiation hazards in atmosphere and space.	5

Lecture Schedule

Unit	Topic	Lecture hrs.	Method
1	MEDICAL INSTRUMENTS	15	Lecture with Demo
2	RADIATION	15	Lecture with Practice
Total		30	

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19CL21	Major Practical-I	LAB			4	3

Year	Semester	Int. Marks	Ext.Marks	Total
First	First & Second	40	60	100

Course Outcomes

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

1. Understand the experimental ideas related with matter, laws of heat
2. Identify the link between theory and practical
3. Analyze observations and make meaningful conclusions

List of experiments

1. Young's modulus – Uniform bending
2. Young's modulus- Non-Uniform bending
3. Melde's string
4. Viscosity – Poiseuille's flow
5. Surface tension – Quincke's drop
6. Surface tension and interfacial surface tension
7. Lee's disc
8. Specific heat by Newton's law of cooling
9. Thermo emf – Potentiometer
10. Thermocouple-emf
11. Torsion Pendulum
12. Compound Pendulum
13. Specific heat capacity of solids
14. Spectrometer – Dispersive power of a prism
15. Calibration of Ammeter- Potentiometer
16. Voltmeter calibration – Potentiometer
17. Volume resonator
18. Determination of M and B_H
19. Current and voltage sensitiveness – MG
20. Carey Foster's Bridge

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19CL41	Major Practical-I I	LAB			4	3

Year	Semester	Int. Marks	Ext.Marks	Total
Second	Third & Fourth	40	60	100

Course Outcomes

On the successful completion of the course, students will be able to
1. Understand the experimental ideas related with mechanics and optics.
2. Identify the link between theory and practical
3. Appreciate the applications of transistors and diodes
4. Analyze observations and make meaningful conclusions

List of experiments

1. Spectrometer – Angle of the prism
2. Newton's rings
3. Grating normal incidence N & for Hg spectrum
4. Comparison of capacities – BG
5. LCR circuit – series resonance
6. LCR circuit – parallel resonance
7. i-d curve 8. Sonameter – frequency of AC mains
8. Comparison of mutual inductances
9. Absolute determination of mutual inductance
10. Verification of Thevenin's/Norton's theorem
11. Half wave rectifier
12. Bridge rectifier
13. Zener diode characteristics
14. Determination of Capacity (absolute)
15. Low pass, High pass, Band Pass RC filters
16. Comparison of resistance – BG
17. Transistor characteristics-CB mode
18. Transistor characteristics-CE mode
19. Logic gates – NAND, NOR, NOT using diodes and transistor

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19CL61	Major Practical- III	LAB			4	3

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Fifth &Sixth	40	60	100

Course Outcomes

On the successful completion of the course, students will be able to
1. Understand the experimental ideas related with matter, optics, electricity and magnetism.
2. Analyze observations and make meaningful conclusions

List of experiments

1. i-i' curve
2. Air wedge
3. Polarimeter
4. Cachy's constant
5. Hartmann's constant
6. Conversion of Galvanometer in to voltmeter
7. Conversion of Galvanometer into ammeter
8. Owen's bridge 9. Maxwell's bridge
10. Grating II order spectrum
11. High resistance by leakage
12. Electrochemical equivalence of copper
13. Determination of Planck's constant
14. Determination of dielectric constant
15. Hall probe method for measurement of magnetic field
16. Abbe's refractometer
17. Find roots of equation by using Newton Raphson method
18. Find roots of equation by using Bisection method
19. Find roots of equation by using False position method
20. Defect detection-Ultrasonic flaw detector

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined B.Sc. Physics on or after June 2019)
PROGRAMME CODE: UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19CL62	Major Practical- IV	LAB			4	3

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Fifth & Sixth	40	60	100

Course Outcomes

On the successful completion of the course, students will be able to
1. Identify the link between theory and designing workable circuits
2. Troubleshoot any simple electronic circuits
3. Appreciate the applications of diodes, transistors and op-amps
4. Report observations and analyses in a scientific manner

List of experiments

1.Single Stage Amplifier
2.Hartley Oscillator
3.Colpitts Oscillator
4.Phase shift oscillator
5.Voltage Doubler
6.Dual Power supply
7.Astablemultivibrator (using transistor)
8.Inverting and non-inverting amplifiers using Op-amp.
9.Op-Amp integrator and differentiator.
10. Adder and subtractor using Op-amp.
11. Monostablemultivibrator (using 555)
12. Astablemultivibrator (using 555)
13. Logic Gates (using ICs)
14. Half Adder & full Adder (Construction using IC's)
15. Zener voltage regulator
16. NAND as Universal gate
17. R-S flip flop.
18. Transistor voltage regulator.
19. FET characteristics.
20. JK flip flop.

THIAGARAJAR COLLEGE, MADURAI – 9.
DEPARTMENT OF PHYSICS
(For those joined B.Sc. Mathematics and Chemistry on or after June 2019)
PROGRAMME CODE : UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19GE11C/ UPH19GE 31M	**PHYSICS – I**	**Allied**	**4**			**4**

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

Preamble

- Understand the basic concepts in mechanics and properties of matter.
- Differentiate Elastic and inelastic collisions with examples.
- Know the different moduli of elasticity and the phenomenon of viscosity.
- Relate the phenomenon discussed under Geometrical and physical Optics in day to day life.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Distinguish different types of forces existing in nature; work, power and energy involved in translatory and rotational motion.	K1, K3
CO2	Classify Elastic and inelastic collisions with examples and to calculate the energy loss during impact.	K1, K2
CO3	Understand the concept of Elasticty, viscosity, Bernouill`s theorem and its applications.	K2, K3
CO4	Know the different types of lenses, principal points, cardinal points and the equivalent focal length of the lens system.	K2, K3
CO5	Learn the principles of Interference, Diffraction and polarization and the experiments related to them.	K1, K3

Mapping of COs with POs

#	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

Blooms taxonomy

	CA		End of Semester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

Title of the paper

PHYSICS -I

Unit I: MECHANICS

Force, Work, Power and Energy Conservative and nonconservative force with example- Friction – central forces - work done by a force – work done by a varying force – Expression for kinetic energy – Expression for potential energy - power. **Rotational motion** Torque work and power in rotational motion - (derviations of expressions) – Torque and angular acceleration – Angular momentum and angular impulse – K.E. of rotation – motion along the inclined plane – diatomic molecule – reduced mass.

Unit II: IMPULSE AND IMPACT

Impulse and momentum – Elastic and Inelastic impacts – Direct impact of two smooth spheres – Expressions of final velocities – Loss of energy due to impact

Unit III: PROPERTIES OF MATTER

Viscosity Stokes law – Determination of a viscosity of liquid (theory and experiment) – Derivation of Peiseuille‟ s formula (Analytical method) – Bernoullistheorem- proof and application. **Elasticity** Elastic moduli – Bending of beams – Expression for B.M – E by uniform bending (theory and experiment) – E by non –uniform bending (Theory and experiment) –I section girders – Torsion – Expression for couple per unit twist – work done in twisting – Torsion pendulum (Theory and Experiment).

Unit IV: GEOMETRICAL OPTICS

Deviation produced by a thin lens – focal length of two thin lenses in contact – Equivalent focal length of two lenses separated by a distance – Principal points – Cardinal points – Dispersion of light – Dispersion through a prism – Dispersive power.

Unit V: PHYSICAL OPTICS

INTERFERENCE : Interference in thin films – Air wedge – Newton's rings – Diffraction grating – Determination of wavelength of light using transmission grating (normal incidence) – POLARISATION : Double refraction – Huygens theory – Nicol prism – QWP – HWP – Optical activity – Biot's law – Specific rotator power – Laurent's halfshadepolarimeter.

TEXT BOOK:

1. Murugeshan, R. 1998. Optics and Spectroscpy, S.Chand& Co., New Delhi,

REFERENCE BOOKS:

1. Sears, Zemansky and Young, 2005. University Physics (6th ed.), Narosa Publishing House, New Delhi
2. Mathur, D.S. 2004. Elements of Properties of Matter, S. Chand & Co. New Delhi.
3. Venkatachalam, N. 1999. Optics and Spectroscopy, CMN Publications.

Web Resources:

1. https://en.wikipedia.org/wiki/Conservative_force
2. https://en.wikipedia.org/wiki/Viscosity
3. https://en.wikipedia.org/wiki/Newton%27s_rings
4. https://en.wikipedia.org/wiki/Impulse_(physics)

Course designers:

1. Mrs.R.Sribala
2. Dr.J.Suvetha Rani
3. Mr.S.Alaguraja

Lecture Schedule

	Topic	No.of Lecture hrs.
1.1	Conservative and nonconservative force with example- Friction – central forces - work done by a force – work done by a varying force	4

1.2	Expression for kinetic energy – Expression for potential energy - power. **Rotational motion** Torque work and power in rotational motion - (derviations of expressions)	4
1.3	Torque and angular acceleration – Angular momentum and angular impulse – K.E. of rotation – motion along the inclined plane – diatomic molecule – reduced mass.	4
2.1	Impulse and momentum – Elastic and Inelastic impacts	4
2.2	Direct impact of two smooth spheres	4
2.3	Expressions of final velocities – Loss of energy due to impact	4
3.1	**Viscosity** Stokes law – Determination of a viscosity of liquid (theory and experiment) – Derivation of Peiseuille‟ s formula (Analytical method)	4
3.2	Bernoullis'theorem proof and application. **Elasticity** Elastic moduli – Bending of beams – Expression for B.M – E by uniform bending (theory and experiment)	4
3.3	E by non –uniform bending (Theory and experiment) –I section girders – Torsion – Expression for couple per unit twist – work done in twisting – Torsion pendulum (Theory and Experiment).	4
4.1	Deviation produced by a thin lens – focal length of two thin lenses in contact – Equivalent focal length of two lenses separated by a distance	4
4.2	Principal points – Cardinal points – Dispersion of light	4
4.3	Dispersion through a prism – Dispersive power.	4
5.1	Interference in thin films – Air wedge – Newton‟ s rings – Diffraction grating	4
5.2	Determination of wavelength of light using transmission grating (normal incidence)- Double refraction – Huygens theory	4
5.3	Nicol prism – QWP – HWP – Optical activity – Biot's law – Specific rotator power – Laurent‟ shalfshadepolarimeter.	4

THIAGARAJAR COLLEGE, MADURAI – 9.
DEPARTMENT OF PHYSICS
(For those joined B.Sc. Mathematics and Chemistry on or after June 2019)
PROGRAMME CODE : UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19GE21C/ UPH19GE 41M	**BASIC ELECTRONICS**	**Allied**	**4**			**4**

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

Preamble

- Know the physics behind semiconductors and the working of rectifiers in depth.
- Understand the basics of transistors and their characteristics.
- Acquire the skill of computing addition, subtraction, multiplication and division using binary numbers.
- Learn the working of basic as well as universal logic gates and their characteristics.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Gain a sound knowledge in semiconductor Physics, types of diodes, working of rectifiers and filters.	K1, K3
CO2	Understand the formation of transistors and their characteristics.	K1, K2
CO3	Learn the fundamentals of number system viz., -Binary, decimal and Hexadecimal numbers.	K2, K3
CO4	Construct logic gates using discrete components and IC`s and to calculate their output voltage.	K2, K3
CO5	Apply De Morgan`s theorem in Boolean algebra and the role of binary adders.	K1, K3

Mapping of COs with POs

#	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

Blooms taxonomy

	CA		End of Semester
	First	**Second**	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%
Total Marks	**52**	**52**	**140**

Title of the paper

BASIC ELECTRONICS

ANALOG ELECTRONICS

Unit I: SEMICONDUCTOR

Semiconductor Physics – intrinsic, extrinsic semiconductor – Band Energy Diagram - Energy Gap – Majority and Minority Carriers – Potential Barrier. Semi conductor diodes: Introduction – Types – PN junction – Biasing – Diode types – Characteristics – Rectifiers – Filters.

Unit II: TRANSISTORS

Transistors – Biasing – Transistor as an amplifier – Current flow in a CE PNP transistor – Static characteristics – Single stage amplifier – Frequency response – Feedback in amplifier – Characteristics of negative feedback.

DIGITAL ELECTRONICS

Unit III: NUMBER SYSTEMS

Binary number system: Conversion of decimal number into binary number – a Binary to decimal conversion – Binary addition – Binary subtraction – Binary multiplication and division – exadecimal numbers – Binary to hexadecimal conversion – Hexadecimal to decimal conversion – Decimal to hexadecimal conversion – Binary coded decimal – Application of BCD code.

Unit IV: LOGIC GATES

Logic gates – Gate and switch – Basic logic gates and their implementation – Characteristics of logic gates – Calculation of output voltage in an OR logic gate &AND logic gate – The NOR logic gate – The NAND logic gate – The exclusive OR gate – Boolean equations of logic circuits.

Unit V BOOLEAN ALGEBRA

De Morgan‟ s laws and its applications: Boolean algebra – De Morgan‟ s laws – Applications – Binary adders

TEXTBOOK:

1. Ambrose , A. Vincent Devaraj, T. 1993. Elements of Solid State Electronics, Mera Publications [Unit I, Sections 3.2.1, 3.3, 3.4, 3.5, 4.1-4.5; Unit II, Sections 5.1- 5.4, 5.5.1, 5.6, 5.6.1, 6.9.1, 6.12, 7.1, 7.2, 7.3.1, 7.3.2]
2. Jose Robin G. ,Ubald Raj, A. 1994. Electronics II, Indira Publication [Units III, IV & V: Chapter 1, 2 (p.22-54) & Chapter 3]

Web Resources:

1. https://en.wikipedia.org/wiki/Transistor
2. https://en.wikipedia.org/wiki/Logic_gate
3. https://www.electronics-tutorials.ws/diode/diode_1.html
4. https://en.wikipedia.org/wiki/Rectifier

Course designers:

1. Mrs.R.Sribala Dr.J.Suvetha Rani Mr.S.Alaguraja

Lecture Schedule:

	Topic	No.of Lecture hrs.
1.1	Semiconductor Physics – intrinsic, extrinsic semiconductor – Band Energy Diagram - Energy Gap	4
1.2	Majority and Minority Carriers – Potential Barrier. Semi conductor diodes:	4
1.3	Introduction – Types – PN junction – Biasing – Diode types – Characteristics – Rectifiers – Filters.	4
2.1	Transistors – Biasing – Transistor as an amplifier – Current flow in a CE PNP transistor	4

2.2	Static characteristics – Single stage amplifier – Frequency response	4
2.3	Feedback in amplifier – Characteristics of negative feedback.	4
3.1	Binary number system: Conversion of decimal number into binary number – a Binary to decimal conversion	4
3.2	Binary addition – Binary subtraction – Binary multiplication and division – exadecimal numbers – Binary to hexadecimal conversion	4
3.3	Hexadecimal to decimal conversion – Decimal to hexadecimal conversion – Binary coded decimal – Application of BCD code.	4
4.1	Logic gates – Gate and switch – Basic logic gates and their implementation	4
4.2	Characteristics of logic gates – Calculation of output voltage in an OR logic gate &AND logic gate	4
4.3	The NOR logic gate – The NAND logic gate – The exclusive OR gate – Boolean equations of logic circuits.	4
5.1	De Morgan's laws and its applications: Boolean algebra	4
5.2	De Morgan's laws – Applications	4
5.3	Binary adders	4

THIAGARAJAR COLLEGE, MADURAI – 9.
DEPARTMENT OF PHYSICS
(For those joined B.Sc. Mathematics and Chemistry on or after June 2019)
PROGRAMME CODE : UPH

Course Code	Course Title	Category	L	T	P	Credit
UPH19GL21C/ UPH19GL41M	**ALLIED PHYSICS PRACTICAL**	**Allied**			**2**	**2**

Year	Semester	Int. Marks	Ext. Marks	Total
First / Second	Second/Fourth	40	60	100

Course Outcomes

On the successful completion of the course, students will be able to
1. Identify the link between theory and practical
2. Develop the skill of performing experiments accurately
3. Report observations and analyses in a scientific manner

List of experiments

1. Compound pendulum
2. Torsion pendulum
3. Sonometer I and II laws
4. Uniform bending using microscope
5. Non –uniform bending using microscope
6. Melde‟ s string
7. Surface tension using capillary rise
8. Surface and interfacial tension- drop weight method
9. Co-efficient of viscosity- using burrette
10. N and λ-Grating
11. Gates- discrete components
12. Zener diode characteristics
13. Dispersive power
14. Newton’s rings
15. Air wedge
16. Sonometer AC mains
17. Carey Foster’s bridge
18. Bridge rectifier
19. Conversion of galvanometer into voltmeter
20. Gates using ICs

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A' Grade by NAAC)

ENVIRONMENTAL STUDIES

(For those joined B.A., B.Sc., B.Com., B.B.A., B.C.A on or after June 2019)

Course Code	Course Title	Category	L	T	P	Credit
U19EVS11	**Environmental Studies**	AECC1	2	-	-	2

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	15	35	50

Preamble

Students acquire knowledge on the basic concepts, components and importance of environment.

Course Outcomes

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

	Course outcomes	Knowledge Level
CO1	Define the structure and functions of ecosystem	K1
CO2	Explain the benefits of biodiversity conservation	K2
CO3	Summarise the sources, effects and control measures of various types of Pollutants	K1
CO4	Perceive the environment legislations in India for sustainable development.	K3

K1: Knowledge K2: Understand K3: Apply

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Unit I

Definition and Scope of Environmental Studies – Ecology and Ecosystem – Structure of an Ecosystem – Food chains, food webs and ecological pyramids – Causes of Biodiversity Loss – Benefit and Conservation of Biodiversity

Unit II

Environmental problems and Management: Causes, effects and Control measures of : Air PSOllution – Water PSOllution – Noise PSOllution – Nuclear Hazards. Solid waste management and Waste DisPSOsal methods. Climate change and Global Warming causes and Measures. Waste and Plastics. Urban environmental problems and measures. Environmental Legislations in India. Sustainable development and Inclusive growth.

Text Book

1. Kanagasabai, C.S. 2005.Environmental Studies. Rasee publishers. Madurai.

Reference Books

1. Yogendra, N. and Srivastava, N. 1998. Environmental PSOllution, Ashish Publishing House. New Delhi.

Sapru R.K.2001. Environment Management in India, Vol. I & Vol. II Ashish publishers house, New Delhi.

THIAGARAJAR COLLEGE, MADURAI – 9.

(Re-Accredited with 'A' Grade by NAAC)

VALUE EDUCATION

(For those joined B.A., B.Sc., B.Com., B.B.A., B.C.A on or after June 2019)

Course Code	Course Title	Category	L	T	P	Credit
U19VE51	**Value Education**	AECC1	2	-	-	2

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Fifth	15	35	50

Preamble

Students acquire knowledge on the basic concepts, components and importance of environment.

Course Outcomes

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

	Course outcomes	Knowledge Level
CO1	Define the structure and functions of ecosystem	K1
CO2	Explain the benefits of biodiversity conservation	K2
CO3	Summarise the sources, effects and control measures of various types of Pollutants	K1
CO4	Perceive the environment legislations in India for sustainable development.	K3

K1: Knowledge K2: Understand K3: Apply

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Unit I

Self Development – Introduction - Definition and Types of Values – Self Assessment – Values needed for self development - Values needed for family life –Principles of happy living

Character development- Good character – Good relationships - Legendary people of highest character – The quest for character –Developing character -The key to good character.

Unit II:

Positive Thinking and Self Esteem - Types of thoughts - Areas of thinking - Developing thought pattern - External influences on Thoughts - Methods to keep outlook positive – Meaning of Self Esteem – Self empowerment.

Stress free living – Illusions and causes - Symptoms and stages of stress – Self confidence– Role models and leadership qualities – Critical thinking - Communication skills – Happy and successful life.

Reference
Study material / Course material

Values for Excellence in Life‖ Compiled by then Curriculum Development Cell Thiagarajar College, Madurai, in collaboration with the Education wing, Brahma Kumaris, Madurai.

விழுமியக் கல்வி

கூறு - 1

சுய முன்னேற்றம்

அறிமுகம் - விழுமியங்களின் விளக்கம் மற்றும் வகைகள் - சுயமதிப்பீடு - சுய முன்னேற்றத்திற்கு விழுமியங்களின் தேவை - குடும்ப வாழ்க்கைக்கு விழுமியங்களின் தேவை - மகிழ்ச்சியான வாழ்க்கைக்கான கொள்கைகள்

பண்பு வளர்ச்சி

நற்பண்பு - நல்லுறவு - உயரிய பண்புகளால் உயர்ந்த பெருமக்களாதல் - பண்புகளைத் தேடல் - பண்புகளை வளர்த்தல் - நற்பண்புகளுக்கான திறவுகோல்.

கூறு - 2

சுயமரியாதையும் நேர்மறைச் சிந்தனையும்

சிந்தனையின் வகைகள் - சிந்தனைப் பகுதிகள் - சிந்தனையை வளர்க்கும் முறை - சிந்தனையில் புறத்தாக்கங்கள் - நேர்மறைப் பண்பை வெளித்தோற்றத்தில் காட்டும்முறை - சுயமரியாதையின் பொருள் - சுய அதிகாரமளித்தல்

அழுத்தமில்லா வாழ்க்கை

பிரமைகளும் காரணங்களும் - அழுத்த நிலைகளுக்கான அறிகுறிகள் - தன்னம்பிக்கை - தலைமைப் பண்பில் முன்னுதாரணங்கள் - விமர்சனச் சிந்தனை - தொடர்புத் திறன்கள் - மகிழ்ச்சி மற்றும் வெற்றிகரமான வாழ்க்கை

Reference

Study material / Course material

"Values for Excellence in Life" Compiled by then Curriculum Development Cell Thiagarajar College, Madurai, in collaboration with the Education wing, Brahma Kumaris, Madurai

Self Study Paper

Thiagarajar College (Autonomous) :: Madurai – 625 009
SELF STUDY PAPER
(For those joined UG on or after June 2019)

Course Code	Course Title	Category	L	T	P	Credit
U19SS51	**Soft Skills**	Self Study Paper	-	-	-	5

Year	Semester	Int. Marks	Ext.Marks	Total
Third	Fifth	----	100	100

*** Carries Extra 5 credits that do not form part mandatory credits (140) required for completion of the course. Optional paper not compulsory for all UG students.**

Preamble

Prepare the students to develop skills, provide training to face interview .prepare themselves with the right skill-sets and attitude

Course Outcomes

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

	Course outcomes	Knowledge Level
CO1	Possess a basic idea on the understanding of nature, cause, effect and ways to deal with critical challenges in everyday life	K1,K2
CO2	Overcome the aspects such as Communication barriers, Stress management, Emotions.	K3
CO3	Gain insights into high-in-demand soft skills and prepare themselves with the right skill-sets and attitude	K1,K2
CO4	Develop or take part inteam work, Thinking skills, Creativity and time management.	K3
CO5	Prepare themselves to face different levels of interviews. Develop skills to manage an organization	K3

K1: Knowledge K2: Understand K3: Apply

Blooms taxonomy: Assessment Pattern

	CA		End of Semester
	First	Second	
Knowledge	40%	40%	40%
Understand	40%	40%	40%
Apply	20%	20%	20%

Unit - 1

Self Awareness (Concept of Self-esteem, Positive and Negative self esteem) Motivation (Nature and types, Factors enhancing and affecting Motivation, Needs and Drives) (Creativity Introduction, Nature of Creativity, Stages of Creativity, Enhancing Creativity, Verbal and Non Verbal Creativity) Values and Ethics (Nature and Significance, Values, Ethics, Work Ethics, Character building, Manners and Ethics)

Self Management (Self management skills and Social Competency, Social Competency Behaviour, Value Orientation, Life goals)

Unit 2

Communication and Thinking Communication (Definition, Types, Styles, Culture and Communication); Thinking (Nature, Types, Problem Solving, Proactive thinking, Positive Thinking, Assertiveness)

Unit 3

Emotions (Nature of emotions, Emotional Intelligence and its strategies, Attachment, Love, Happiness, Introduction to Anger – Causes, Types, Functions and Consequences, Anger management)

Stress (Nature of stress, Relation between Demands and Coping, Types and Causes, Effects and Indicators, Management of Stress, Time management and Stress reduction) Empathy (Definition, Nature and Factors enhancing empathy)

Unit4

Excelling through a placement process(Resume writing; Taking a written test; Group discussion – Need, Types, Tips and techniques; Interview handling – Tips and Techniques)

Unit 5

Being effective in an organisation

50 rules of work, Professional Etiquettes and Mannerism, Building relationship within an organisation, Communication skills, Working in teams, Managing conflicts, Effective negotiation skills, Problem solving using creativity.

Text book

1. Life Skills for Success – AlkaWadkar – 2016 Edition SAGE | TEXTS Sagepublishing.com
2. Campus to Corporate – Roadmap to Employability – Gangadhar Joshi – 2015 Edition SAGE | TEXTS Sagepublishing.com

Reference textbook

1 ACE of Soft skills – Gopalaswamy Ramesh and Mahadevan Ramesh, Pearson Publication
2 Bridging the soft skills gap – Bruce Tulgan – 2015 Edition – Wiley Publication

B.Sc. Physics

Assessment values of course learning outcomes and their mapping with program specific outcomes (PSOs)

Major papers

#	Title of the courses	PSO1	PSO2	PSO3	PSO4	PSO5
UPH19C11	Properties of Matter	14	9	8	9	8
UPH19C12	Heat and Thermodynamics	10	12	12	8	10
UPH19C21	Mechanics	12	9	10	6	8
UPH19C22	Optics	11	9	11	9	7
UPH19C31	Electricity & Magnetism	13	11	8	9	12
UPH19C32	Modern Optics	12	8	13	9	11
UPH19C41	Materials Science	11	9	11	9	7
UPH19C42	Fundamentals of Electronics	10	7	7	9	6
UPH19C51	Elementary Solid State Physics	13	15	12	12	12
UPH19C52	Analog Electronics	12	9	11	10	11
UPH19C53	Modern Physics	12	10	13	10	11
UPH19CE51A	Numerical methods with Programming in C	13	13	9	11	8
UPH19CE51B	Mathematical physics	13	12	8	10	7
UPH19CE51C	Introduction to microprocessor	15	4	7	5	5
UPH19C61	Atomic and Molecular spectroscopy	10	12	12	10	13
UPH19C62	Nuclear and particle physics	14	4	7	5	5
UPH19C63	Digital Electronics	10	10	10	11	11
UPH19CE61A	Introduction to Quantum mechanics	15	4	7	5	5
UPH19CE61C	Electromagnetism	11	13	12	11	11
UPH19CE61B	Optical fiber communication	13	4	9	5	5

NME / SBE papers

#	Title of the courses	PSO1	PSO2	PSO3	PSO4	PSO5
	Environmental Studies					
UPH19AC21	Data analysis and interpretation	5	5	3	5	5
UPH19NE31	Solar energy	6	3	4	1	5
UPH19SE41A	Introduction to nanophysics-I	4	5	5	5	6
UPH19SE41B	Medical physics-I	5	2	2	4	6
UPH19SE41C	Physics in everyday life	6	2	2	3	4
UPH19NE51	Non conventional energy	5	5	4	3	6
	Value Education					
UPH19SE41A	Practical electric circuits	6	3	1	4	5
UPH19SE41B	Introduction to nanophysics-II	5	1	3	4	6
UPH19SE41C	Medical physics-II	6	6	3	3	4

Allied / Ancillary papers

#	Title of the courses	PSO1	PSO2	PSO3	PSO4	PSO5
	Ancillary Mathematics-I					
	Ancillary Mathematics-II					
	Allied – I (Chemistry)					
	Allied – I (Chemistry) - Lab					
	Allied – II (Chemistry)					
	Allied – II (Chemistry) - Lab					

M.Sc. Physics

Programme Code : PPH

Programme outcome-PO (Aligned with Graduate Attributes)- Master of Science (M.Sc.,)

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.

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;

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;

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.

Problem solving

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

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.

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

Program Specific Outcome

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

PSO1	Explain the fundamental principles and concepts of various major areas of theoretical and experimental research
PO2	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, analyses, 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. 2019 batch onwards)
COURSE STRUCTURE
PROGRAMME CODE: PPH

Semester – I

Course	Code	Title of the Paper	Hrs. ++	Credits.	Total No. of Hours	Max. Marks CA	Max. Marks SE	Total Marks
Core -1	PPH19C11	Classical Mechanics	5	4	75	25	75	100
Core -2	PPH19C12	Statistical Mechanics	5	4	75	25	75	100
Core 3	PPH19C13	Advanced Electronics	5	4	75	25	75	100
Elective 1	PPH19CE1(A/B)	Mathematical Physics – I / Computer simulations	5	5	75	25	75	100
Lab	PPH19CL21	General Experiments	5	-	75	-	-	-
Lab	PPH19CL22	Electronics Experiments	5	-	75	-	-	-
Total			**30**	**17**	**450**	**100**	**300**	**400**

Semester – II

Course	Code	Title of the Paper	Hrs. ++	Credits.	Total No. of Hours	Max. Marks CA	Max. Marks SE	Total Marks
Core 4	PPH19C21	Solid state physics -I	5	4	75	25	75	100
Core -5	PPH19C22	Electromagnetic theory	5	4	75	25	75	100
Core - 6	PPH19C23	Quantum mechanics-I	5	4	75	25	75	100
Elective -2	PPH19CE21A/B	Mathematical physics II/ Molecular biophysics	5	5	75	25	75	100
Lab -I	PPH19CL21	General Experiments	5	5	75	40	60	100
Lab -II	PPH19CL22	Electronics Experiments	5	5	75	40	60	100
Total			**30**	**27**	**450**	180	**420**	**600**

Semester – III

Course	Code	Title of the Paper	Hrs. ++	Credits.	Total No. of Hours	Max. Marks CA	Max. Marks SE	Total Marks
Core 7	PPH19C31	Solid state physics -II	5	4	75	25	75	100
Core -8	PPH19C32	Quantum mechanics II	5	4	75	25	75	100
Core - 9	PPH19C33	Nuclear physics	5	4	75	25	75	100
Core - 10	PPH19C34	Microprocessor and Micro Controllers	5	4	75	25	75	100
Lab	PPH19CL41	Advanced Experiments	5	-	75	-	-	-
PJ	PPH19PJ41	Project	7	-	75	-	-	-
Total			**30**	**16**	**450**	**100**	**300**	**400**

Semester – IV

Course	Code	Title of the Paper	Hrs. ++	Credits.	Total No. of Hours	Max. Marks CA	Max. Marks SE	Total Marks
Core 11	PPH19C41	Spectroscopy	5	4	75	25	75	100
Core - 12	PPH19C42	Nanoscience	5	4	75	25	75	100
Core - 13	PPH19C43	Optical communication and networking	5	4	75	25	75	100
Elective - 3	PPH19CE41A/B	X-ray crystallography/ Astrophysics	5	5	75	25	75	100
Lab	PPH19CL41	Electronics	5	6	75	40	60	100
PJ	PPH19PJ41	Electronics	5	7	75	40	60	100
Total			**30**	**30**	**450**	**180**	**420**	**600**

* Credit will be awarded at the end of II/IV Semester

++ 1 Hour for Class Test.

A. Consolidation of contact hours and credits: PG

Semester	Contact Hrs/week	Credits
I	30	17
II	30	27
III	30	16
IV	30	30
Total	**120**	**90**

B) Curriculum Credits

Core --- 75 Credits

Elective ---15 Credits

Total 90 Credits

Thiagarajar College (Autonomous):: Madurai – 625 009
Department of Physics
(For those joined M.Sc. Physics on or after June 2019)
PROGRAMME CODE: PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH19C11	**CLASSICAL MECHANICS**	**Core - 1**	**4**	**1**		**4**

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

Preamble

- Acquire acquaintance with the elementary concepts of mechanics.
- Widen the basic knowledge in the motion of particles and to acquire in-depth knowledge in Lagrangian and Hamiltonian Principles.
- Appreciate the classical theory behind two body problems and small oscillations.
- Gain knowledge on Canonical transformations, Poisson and Lagrange brackets.

Prerequisite

Basic knowledge on Lagrangian and Hamiltonian equation of motion.

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Gain a solid foundation in the mechanics of particles and its extension to Lagrangian and Hamiltonian formulation.	K1, K2
CO2	Develop the concepts of equivalent one body problem, classification of orbits and the Kepler problem involving inverse square law force	K1, K3,k5
CO3	Formulate the problem of small oscillations and free vibrations of linear triatomic molecule.	K5
CO4	Analyze the concepts of Hamiltonian equation, its physical significance and its relevance to Routh`s procedure based on cyclic coordinates.	K4
CO5	Apply the concept of Canonical transformation and to gain knowledge on Lagrange and Poisson brackets.	K1, K3

K1: Knowledge K2: Understand K3: Apply K4:Analyse K5: Evaluate

Mapping of COs with POs

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

Blooms taxonomy

Blooms Taxonomy			
Category	Continuous Assessment		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	20%	20%	20%
Understand -K2	20%	20%	20%
Apply-K3	20%	20%	20%
Analyze-K4	20%	20%	20%
Evaluate-K5	20%	20%	20%
Total Marks	**60**	**60**	**150**

Title of the paper

CLASSICAL MECHANICS

Unit I: SURVEY OF THE ELEMENTARY PRINCIPLES, VARIATIONAL PRINCIPLES AND LAGRANGE'S EQUATIONS

Mechanics of a particle – Mechanics of a system of particles – Constraints – D'Alemberts principle and Lagrange's equation – velocity dependent potentials and the dissipation function – Simple applications of the Lagrangian formulation. Hamilton's principles – some techniques of the calculus of variations – Derivation of Lagrange's equations from Hamilton's principle – Extension of Hamilton's principle to non – conservative and non holonomic systems

Unit II: THE TWO BODY CENTRAL FORCE PROBLEM

Reduction to the equivalent one – body problem the equations of motion and first integrals- The equivalent one – dimensional problem, and classification of orbits – The viral theorem – The Kepler problem – Inverse square law of force.

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 – forced vibrations and the effect of dissipative forces.

Unit IV: THE HAMILTON EQUATION OF MOTION

Legendre transformation and the Hamilton equation of motion – Cyclic coordinates and Routh procedure – conservation theorems and the physical significance of the Hamiltonian – Derivation from variational principle – The principle of least action.

Unit V: CANONICAL TRANSFORMATIONS

The equations of canonical transformation – Examples of canonical transformations – the integral invariants of Poincare – Lagrange and Poisson brackets as canonical invariants – The equations of motion in Poisson bracket notation – Infinitesimal/constant transformations, constants of the motion and symmetry properties.

TEXT BOOK:

1. Goldtsein, H., Poole, C., Safko, J. 2002. Classical Mechanics,III ed, Pearson Education, ISBN 81 – 7808 – 566 – 6.

REFERENCE BOOKS:

1. Dass, T., & Sharma, S.K., 1998. Mathematical Methods in Classical and Quantum Physics, University Press, ISBN 81-7371-089-9.
2. N.C. Rana and P.S. Joag, 2001. Classical Mechanics,McGraw Hill Education (India) Private Limited 1 edition, ISBN 9780074603154.
3. Sankara Rao, K.Classical Mechanics, 2005. Prentice-Hall of India, ISBN 81-203- 2676-8.
4. Bhatia,V.B. Classical Mechanics – With Introduction to Nonlinear Oscillations and Chaos, 1997. Narosa Publishing House, ISBN 81-7319-104-2.

5. Greiner, W. 2004. Classical Mechanics – Systems of Particles and Hamiltonian Dynamics, Springer, ISBN 81-8128-128-4.

Web Resources:

1. https://en.wikipedia.org/wiki/Lagrangian_mechanics
2. https://en.wikipedia.org/wiki/Hamiltonian_mechanics
3. https://en.wikipedia.org/wiki/Two-body_problem
4. https://en.wikipedia.org/wiki/Poisson_bracket

Course Designers:

1. Dr. N.Srinivasan
2. Mrs. R.Sribala

Lecture Schedule

	Topic	No. of Lecture hrs.
1.1	Mechanics of a particle – Mechanics of a system of particles – Constraints – D'Alemberts principle and Lagrange's equation – velocity dependent potentials and the dissipation function	5
1.2	Simple applications of the Lagrangian formulation. Hamilton's principles – some techniques of the calculus of variations.	5
1.3	Derivation of Lagrange's equations from Hamilton's principle – Extension of Hamilton's principle to non – conservative and non holonomic systems	5
2.1	Reduction to the equivalent one – body problem -the equations of motion and first integrals.	5
2.2	The equivalent one – dimensional problem, and classification of orbits.	5
2.3	The viral theorem – The Kepler problem – Inverse square law of force.	5
3.1	Formulation of the problem – The eigen value equation and principle axis transformation.	5
3.2	Frequencies of free vibration and normal coordinate – Free vibrations of linear triatomic molecule.	5
3.3	Forced vibrations and the effect of dissipative forces.	5
4.1	Legendre transformation and the Hamilton equation of motion – Cyclic coordinates.	5
4.2	Routh procedure – conservation theorems and the physical significance of the Hamiltonian	5
4.3	Derivation from variational principle – The principle of least action.	5
5.1	The equations of canonical transformation – Examples of canonical transformations – the integral invariants of Poincare	5
5.2	Lagrange and Poisson brackets as canonical invariants – The equations of motion in Poisson bracket notation	5
5.3	Infinitesimal/constant transformations, constants of the motion and symmetry properties.	5

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined M.Sc. Physics on or after June 2019)
PROGRAMME CODE : PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH19C12	**STATISTICAL MECHANICS**	**Core - 2**	**4**	**1**		**4**

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

Preamble

- Learn the connection between macroscopic and microscopic state of a system of large number of particles
- Recognize thermal equilibrium of a system in statistical sense

Prerequisite

Knowledge on the thermal properties of gases, distribution laws

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Impart knowledge on the basis of classical statistics	K1
CO2	Analyze the basic concepts on Canonical And Grand Canonical Ensembles	K4
CO3	Investigate the basic concepts on Bose – Einstein distribution	K5
CO4	Explore the concepts of Fermi – dirac distribution	K1,K5
CO5	Discuss the properties of Phase transitions	K2, K3

K1: Knowledge K2: Understand K3: Apply K4:Analyse K5: Evaluate

Mapping of COs with POs

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

Blooms taxonomy

Blooms Taxonomy			
Category	**Continuous Assessment**		**End of Semester Marks**
	I Internal Marks	**II Internal Marks**	
Knowledge -K1	20%	20%	20%
Understand -K2	20%	20%	20%
Apply-K3	20%	20%	20%
Analyze-K4	20%	20%	20%
Evaluate-K5	20%	20%	20%
Total Marks	**60**	**60**	**150**

Title of the paper

STATISTICAL MECHANICS

Unit I:

Basis Of Classical Statistics -Phase space – Ensemble – average – Liouville theorem – Conservation of extension in phase – Equation of motion and Liouville theorem – Equal a priori probability – Statistical equilibrium – Micro canonical ensemble. Quantum picture Micro canonical ensemble – Quantization of Phase space – Basic postulates – Classical limit – Symmetry of wave function – Effect of symmetry on counting – Various distributions using micro canonical ensemble – Density matrix.

Unit II:

Canonical And Grand Canonical Ensembles - Ideal gas in canonical ensemble – Maxwell velocity distribution – Equipartition of energy – Grand canonical ensemble – Ideal gas in grand canonical ensemble – Comparison of various ensembles – Quantum distributions using other ensembles – Photons –- Partition Function - Canonical partition function – Molecular partition function – Translational partition function – Rotational partition function – Vibrational partition function – Homo nuclear molecules and nuclear spin.

Unit III :

Ideal Bose – Einstein Gas Bose – Einstein distribution - Bose – Einstein Condensation – Thermodynamic properties of an ideal Bose – Einstein gas – Liquid Helium – Two – Fluid model of Liquid Helium – Landau spectrum of phonons and rotons – 3He – 4He mixtures.

Unit IV:

Ideal Fermi – Dirac Gas Fermi – dirac distribution – Electrons in metals – Thermionic emission – White Dwarfs – Semiconductor Statistics Statistical equilibrium of free electrons in semiconductors – Nondegenerate case – Impurity semiconductors – Degenerate semiconductors.

Unit V:

Cooperative Phenomena : Ising Model Phase transitions of the second kind – Ising model – Bragg – William approximation – Fowler – Guggenheim Approximation – Kirkwood method – One-dimensional Ising model

Text Books:

1. Agarwal, B.K. & Eisner, M. 2006, Statistical mechanics , II ed., New Age International, ISBN-81-224-1157-6

References:

1. Gupta, S.I & Kumar, V. 2006.Elementary Statistical Mechanics , Pragati Prakashan,
2. Zemansky, M.W. & Dittman, R.H.1989. Heat and Thermodynamics,VI ed., McGraw Hill, ISBN 0-07-Y66647-4.
3. Huang, K.1988. Statistical Mechanics, Wiley Eastern, ISBN 0-85226-393-1.
4. Sears, F.W. & Salinger, G.L.1991.Thermodynamics, Kinetic Theory and Statistical Thermodynamics,: Narosa Publishing House, ISBN 81-85015-71-6.

Web Resources:

1. *https://en.wikipedia.org/wiki/Particle_statistics*
2. *https://en.wikipedia.org/wiki/Grand_canonical_ensemble*
3. *hyperphysics.phy-astr.gsu.edu/hbase/quantum/disbe.html*
4. *https://ecee.colorado.edu/~bart/book/book/chapter2/ch2_5.htm*
5. https://www.natur.cuni.cz/chemie/fyzchem/nachtig/prednaskst/Eng_Lecture_11.pdf

Course Designers:

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

Course Contents and lecture Schedule

	Topic	No.of Lecture hrs.
1.1	Basis Of Classical Statistics -Phase space – Ensemble – average – Liouville theorem – Conservation of extension in phase – Equation of motion and Liouville theorem – Equal a priori probability	4
1.2	Statistical equilibrium – Micro canonical ensemble. Quantum picture Micro canonical ensemble – Quantization of Phase space – Basic postulates – Classical limit	4
1.3	Symmetry of wave function – Effect of symmetry on counting – Various distributions using micro canonical ensemble – Density matrix	4
2.1	Canonical And Grand Canonical Ensembles - Ideal gas in canonical ensemble – Maxwell velocity distribution – Equipartition of energy – Grand canonical ensemble	4
2.2	Ideal gas in grand canonical ensemble – Comparison of various ensembles – Quantum distributions using other ensembles – Photons –- Partition Function - Canonical partition function	4
2.3	Molecular partition function – Translational partition function – Rotational partition function – Vibrational partition function – Homo nuclear molecules and nuclear spin	4
3.1	Ideal Bose – Einstein Gas Bose – Einstein distribution - Bose – Einstein Condensation	4
3.2	Thermodynamic properties of an ideal Bose – Einstein gas – Liquid Helium – Two	4
3.3	Fluid model of Liquid Helium – Landau spectrum of phonons and rotons – 3He – 4He mixtures	4
4.1	Ideal Fermi – Dirac Gas Fermi – dirac distribution – Electrons in metals – Thermionic emission	4
4.2	White Dwarfs – Semiconductor Statistics Statistical equilibrium of free electrons in semiconductors	4
4.3	Nondegenerate case – Impurity semiconductors – Degenerate semiconductors	4
5.1	Cooperative Phenomena : Ising Model Phase transitions of the second kind – Ising model	4
5.2	Bragg – William approximation – Fowler – Guggenheim Approximation	4
5.3	Kirkwood method – One-dimensional Ising model	4

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined M.Sc. Physics on or after June 2019)
PROGRAMME CODE : PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH19C13	**ADVANCED ELECTRONICS**	**Core - 3**	**4**	**1**		**4**

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

Preamble

- Realize the characteristics field effect transistors
- Provide an insight about fundamental concepts, techniques and applications of Op-amp
- Furnish exposure on basic digital electronic components, devices and their applications
- Study the characteristics of oscillators and wave shaping circuits.

Prerequisite

Basic knowledge on Analog and Digital Electronics.

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Comprehend the characteristics field effect transistors	K1, K2
CO2	Make out the fundamental concepts of amplifiers and applications of Op-Amp	K1, K3
CO3	Identify the fundamental concepts and techniques used in data storage elements	K5
CO4	Discern the shift registers and the architecture of microprocessor	K4
CO5	Evaluate the characteristics of oscillators and wave shaping circuits	K1, K5

K1: Knowledge K2: Understand K3: Apply K4:Analyse K5: Evaluate

Mapping of COs with POs

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

Blooms taxonomy

Blooms Taxonomy			
Category	Continuous Assessment		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	20%	20%	20%
Understand -K2	20%	20%	20%
Apply-K3	20%	20%	20%
Analyze-K4	20%	20%	20%
Evaluate-K5	20%	20%	20%
Total Marks	**60**	**60**	**150**

Title of the paper

ADVANCED ELECTRONICS

Unit I: SEMICONDUCTOR DEVICES

Field effect transistor: The ideal voltage controlled current source – the Junction Field Effect transistor – the JFET volt – ampere characteristics – JFET transfer characteristics – The MOSFET – The enhancement MOSFET – volt – ampere characteristics – The depletion MOSFET – MOSFET circuit symbols – The DC analysis of FETS – The MOSFET as a resistance – switch – amplifier – small – signal FET models – CMOS devices.

Unit II: AMPLIFIER SYSTEMS

Op.amp – architectures – The gain stage with active load – The differential stage – DC level shifting – output stages – offset voltages and currents – Measurements of op – amp parameters – Frequency response and compensation – slew rate – BIFET and BIMOS circuits - Three stage Op.amp – MOS Op amp.

Unit III: DIGITAL CIRCUITS AND SYSTEMS

Combinatorial – Digital circuits: Standard Gate assembling Binary adders – Arithmetic functions – Digital comparators – Parity checker – Generators – Decoder - Demultiplexer – Data selector – multiplexer encoder – Read only Memory (ROM) – Two dimensional addressing of a ROM – ROM applications – programmable ROMs. – Erasable PROMS – programmable array logic – programmable logic arrays. Sequential circuits and systems: A1 Bit memory – The circuit properties of a Bistable Latch – The clocked SR Flip flops. J - K, – T -, and D - type Flip flops – shift registers – Ripple counters – Synchronous counters – Application of counters.

Unit IV: VERY LARGE SCALE INTEGRATED SYSTEMS

Dynamic MOS shift registers – Ratioless shift register stages – CMOS Domino logic - Random Access Memory (RAM) – Read - write memory cells – Bipolar RAM cells – Charge coupled device (CCD) – CCD structures – Integrated - Injection logic(I2L) – Microprocessors and Micro computers.

Unit V: WAVE FORM GENERATORS AND WAVESHAPING

Wave form Generators and waveshaping : Sinusoidal oscillators – Phase shift: oscillator – Wien bridge oscillator – General form of oscillator configuration – crystal oscillators – multivibrators – comparator – square - wave generation from a sinusoid – Regenerative comparator – Square and triangle - wave generators – pulse generators – The 555 IC timer – voltage time - base generators – step generators – modulation of a square wave.

Text Books:

1. Millman, J & Grabel, A. 2002. Micro Electronics, II ed., Tata McGraw Hill, ISBN 0-07- 463736-3.
   Unit – I Chapter- 4 ; Unit – II Chapter-14; Unit – III Chapter-7 & 8
   Unit – IV Chapters-9 ; Unit – V Chapters-15

. **References:**

1. 1. Malvino, A.P. & Leech, D andGoutam Saha, 2006. Digital Principles and application, VI ed., Tata McGraw Hill, ISBN 0-07- 060175-5.
2. D.P. Leach and A.P. Malvino, *Digital Principals and Applications* (Tata McGraw-Hill, New Delhi, 2006).

Web Resources:

1. https://en.wikipedia.org/wiki/Field-effect_transistor
2. https://en.wikipedia.org/wiki/Operational_amplifier
3. https://en.wikipedia.org/wiki/Function_generator

Course Designers:

1. Dr.R.Vijayalakshmi Dr.R.Srinivasan

Lecture Schedule

	Topic	No.of Lecture
1.1	Field effect transistor: The ideal voltage controlled current source – the Junction Field Effect transistor – the JFET volt – ampere characteristics – JFET transfer characteristics	5
1.2	The MOSFET – The enhancement MOSFET – volt – ampere characteristics – The depletion MOSFET	5
1.3	MOSFET circuit symbols – The DC analysis of FETS – The MOSFET as a resistance – switch – amplifier – small – signal FET models – CMOS devices	5
2.1	Op.amp – architectures – The gain stage with active load – The differential stage – DC level shifting	5
2.2	output stages – offset voltages and currents – Measurements of op – amp parameters – Frequency response and compensation	5
2.3	slew rate – BIFET and BIMOS circuits - Three stage Op.amp – MOS Op amp.	5
3.1	Combinatorial – Digital circuits: Standard Gate assembling Binary adders – Arithmetic functions – Digital comparators – Parity checker – Generators – Decoder - Demultiplexer – Data selector	5
3.2	multiplexer encoder – Read only Memory (ROM) – Two dimensional addressing of a ROM – ROM applications – programmable ROMs. – Erasable PROMS – programmable array logic - programmable logic arrays	5
3.3	Sequential circuits and systems: A1 Bit memory – The circuit properties of a Bistable Latch – The clocked SR Flip flops. J - K, – T -, and D - type Flip flops – shift registers – Ripple counters – Synchronous counters – Application of counters.	5
4.1	Dynamic MOS shift registers – Ratioless shift register stages – CMOS Domino logic - Random Access Memory (RAM)	5
4.2	Read - write memory cells – Bipolar RAM cells – Charge coupled device (CCD)	5
4.3	CCD structures – Integrated - Injection logic(I2L) – Microprocessors and Micro computers	5
5.1	Wave form Generators and waveshaping : Sinusoidal oscillators – Phase shift: oscillator – Wien bridge oscillator – General form of oscillator configuration	5
5.2	crystal oscillators – multivibrators – comparator – square - wave generation from a sinusoid – Regenerative comparator	5
5.3	Square and triangle - wave generators – pulse generators – The 555 IC timer – voltage time - base generators – step generators – modulation of a square wave	5

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined M.Sc. Physics on or after June 2019)
PROGRAMME CODE : PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH19CE1A	**MATHEMATICAL PHYSICS – I**	**Elective - 1**	**4**	**1**	**-**	**5**

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

Preamble

- Focuses to enable the students to apply the mathematical concepts in physics.
- Rendering students to solve problems with different methods of matrix.
- Expertise in Beta, Gamma and special functions.

Prerequisite

Firm understanding of basic concepts of vector, matrices, differential and integral calculus.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Instruct on the students the elementary knowledge about curvilinear coordinates	K1, K3
CO2	Provide the students enough problems in matrices so as to prepare them for competitive exams	K2, K3
CO3	Recognize to apply the mathematical concepts to solve the problems	K3, K5
CO4	Analyze the basics of Legendre's differential equations	K4
CO5	Investigate the Bessel functions and move on to the advanced level	K3,K5

K1: Knowledge K2: Understand K3: Apply K4:Analyse K5: Evaluate

Mapping of COs with POs

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

Blooms taxonomy

Blooms Taxonomy			
Category	**Continuous Assessment**		**End of Semester Marks**
	I Internal	**II Internal**	
Knowledge -K1	20%	20%	20%
Understand -K2	20%	20%	20%
Apply-K3	20%	20%	20%
Analyze-K4	20%	20%	20%
Evaluate-K5	20%	20%	20%
Total Marks	**60**	**60**	**150**

Title of the paper

MATHEMATICAL PHYSICS – I

Unit I: CURVILINEAR COORDINATES:

Transformation of coordinates – Jacobian of transformations - Orthogonal curvilinear coordinates – Coordinate surfaces and coordinate curves – Scale factors and unit vectors in curvilinear systems – Arc length and volume elements – Gradient, divergence and curl in orthogonal curvilinear systems – Special orthogonal coordinate systems – Cylindrical and spherical coordinate systems – Position vector, velocity, acceleration, Gradient, Divergence, Curl and Laplacian.

Unit II: DETERMINANTS AND MATRICES :

Linear, homogeneous and inhomogeneous equations – Examples – Solving linear equations (Gauss elimination) – Matrix inversion (Gauss-Jordan) – Orthogonal matrices, direction cosines, applications to vectors, orthogonality conditions (two-dimensional case) – Symmetry property and similarity transformations – Hermitian and unitary matrices – Pauli matrices – Eigenvalues and eigenvectors - Diagonalisation of matrices.

Unit III: THE BETA AND GAMMA FUNCTIONS : Definitions-symmetry property of Beta Functions-evaluation of Beta Functions - transformation of Beta Functions -evaluation of Gamma Function- transformation of Gamma Functions- relation between Beta and Gamma Functions-evaluation of miscellaneous integrals-miscellaneous important prepositions.

Unit IV: SPECIAL FUNCTIONS-I : Legendre's differential equation and Legendre Functions – Generating function of Legendre Polynomial-Rodrigue's formula for Legendre Polynomials–orthogonal properties of Legendre's polynomial- – Recurrence Formulae for $P_n(x)$

Unit V: SPECIAL FUNCTIONS-II : Bessel's differential equation: Bessel's polynomial –Recurrence Formulae for $J_n(x)$– generating function for $J_n(x)$–Jacobi series-Bessel's integrals-Orthonormality of Bessel's functions-spherical Bessel's function-Recurrence relation-Orthogonality of Spherical Bessel's functions.

Text Books:

1. SPIEGEL, M.R., 1959,Schaum's outline of theory and problems of vector analysis and an introduction to tensor analysis, McGraw Hill, ISBN:07-060228-X. (Unit I : Chapter 7)
2. WEBER, H.J. &ARFKEN, G.B. 2003.Essential mathematical methods for physicists, Academic Press, ISBN:0-12-059877-9 (Unit II : Chapter 3)
3. Satya Prakash, 2005. Mathematical Physics with Classical Mechanics, Sultan Chand & Sons, ISBN:81-7014-925-8
   UNIT III: Chapter 4 (sec 4.1-4.9)
   UNIT IV: Chapter 6 (sec 6.7-6.11)
   UNIT V: Chapter 6 (sec 6.17, 6.21-6.25,6,28,6.28a,6.28b).

References:

1. Riley, K.F., Hobson, M.P.& Bence, S.J. 2004. Mathematical Methods for Physics and Engineering II ed.,Cambridge, ISBN:0-521-61296-9.
2. Ghatak, A.K., Goyal, I.C. & Chua, 2002. Mathematical Physics – Differential Equations and Transform Theory, Macmillan, ISBN:0-333-92548-3.
3. Gupta, B.D. 1993. Mathematical Physics, II ed, Vikas Publishing House, ISBN:0-7069-76-4.

Web Resources:

1. *https://en.wikipedia.org/wiki/Curvilinear_coordinates*
2. https://www.hec.ca/en/cam/help/topics/Matrix_determinants.pdf
3. *https://homepage.tudelft.nl/11r49/documents/wi4006/gammabeta.pdf*
4. *https://en.wikipedia.org/wiki/Special_functions*

Course Designers:

1. Dr.R.V.Krishnakumar
2. Dr.V.Rajniswami

Lecture Schedule

	Topic	No.of Lecture hrs.
1.1	Transformation of coordinates – Jacobian of transformations - Orthogonal curvilinear coordinates	5
1.2	Coordinate surfaces and coordinate curves – Scale factors and unit vectors in curvilinear systems – Arc length and volume elements – Gradient, divergence and curl in orthogonal curvilinear systems	5
1.3	Special orthogonal coordinate systems – Cylindrical and spherical coordinate systems – Position vector, velocity, acceleration, Gradient, Divergence, Curl and Laplacian	5
2.1	Linear, homogeneous and inhomogeneous equations – Examples – Solving linear equations (Gauss elimination) – Matrix inversion (Gauss-Jordan)	5
2.2	Orthogonal matrices, direction cosines, applications to vectors, orthogonality conditions (two-dimensional case) – Symmetry property and similarity transformations	5
2.3	Hermitian and unitary matrices – Pauli matrices – Eigenvalues and eigenvectors - Diagonalisation of matrices	5
3.1	Definitions-symmetry property of Beta Functions-evaluation of Beta Functions	5
3.2	evaluation of Beta Functions - transformation of Beta Functions - evaluation of Gamma Function- transformation of Gamma Functions	5
3.3	relation between Beta and Gamma Functions-evaluation of miscellaneous integrals-miscellaneous important prepositions	5
4.1	Legendre's differential equation and Legendre Functions	5
4.2	Generating function of Legendre Polynomial-Rodrigue's formula for Legendre Polynomials	5
4.3	orthogonal properties of Legendre's polynomial- – Recurrence Formulae for $P_n(x)$	5
5.1	Recurrence Formulae for $J_n(x)$– generating function for $J_n(x)$–Jacobi series-Bessel's integrals	5
5.2	Orthonormality of Bessel's functions-spherical Bessel's function-Recurrence relation	5
5.3	Orthogonality of Spherical Bessel's functions	5

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined M.Sc. Physics on or after June 2019)
PROGRAMME CODE : PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH19CE1B	**COMPUTER SIMULATIONS**	**Elective -1**	**5**	**1**		**5**

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

Preamble

- Focuses to enable the students to apply the mathematical concepts in physics.
- Rendering students to solve problems with different methods of matrix.
- Expertise in Beta, Gamma and special functions.

Prerequisite

Knowedge on basic statistical mechanics and numerical methods

Preamble

- Know the importance of computers in physics
- Learn the Chaotic motion of dynamical systems and to solve the problems in probability.
- Solve numerical integration of one and multi dimensional integrals, Monte carlo error, and non uniform probability.
- Acquire the knowledge of Ising model, Ising phase transition and applications of Ising model.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Know the importance of graphics, Numerical solution to simple harmonic oscillator of falling objects	K1, K2
CO2	Analyze Chaotic motion of dynamical systems , measuring and controlling chaos and about Hamiltonian chaos.	K1, K3
CO3	Realize the concept of Random walks, modified random walks, Numerical integration and Monte Carlo methods.	K2, K5
CO4	Explore about Fractal dimension, Regular fractals and growth processes.	K4
CO5	Interpret the Ising model, Ising phase transition and its applications.	K1, K5

K1: Knowledge K2: Understand K3: Apply K4:Analyse K5: Evaluate

Mapping of COs with POs

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

Blooms taxonomy

Blooms Taxonomy			
Category	**Continuous Assessment**		**End of Semester Marks**
	I Internal Marks	**II Internal Marks**	
Knowledge -K1	20%	20%	20%
Understand -K2	20%	20%	20%
Apply-K3	20%	20%	20%
Analyze-K4	20%	20%	20%
Evaluate-K5	20%	20%	20%
Total Marks	**60**	**60**	**150**

Title of the paper COMPUTER SIMULATIONS

Unit I:

Importance of Computers in Physics – Nature of Computer Simulation – Importance of Graphics – Programming Languages – Euler Algorithm – Example Coffee Cooling problem – Accuracy and stability – Visualization – Nuclear decay – Simple Harmonic Motion Motion – Numerical solution to simple harmonic oscillator of falling objects – Simple pendulum – Dissipative systems – Response to external forces – Electrical circuit oscillations.

Unit II:

Chaotic motion of dynamical systems – periodic doubling – measuring and controlling chaos – Forced damped pendulum – Hamiltonian chaos – Perspective – Order – disorder – Poisson distribution and nuclear decay - introduction to0 random walks – Problems in probability – method of least squares – Simple variational Monte Carlo method – Random walks and diffusion equations.

Unit III:

Random walks, modified random walks, application to polymers, diffusion controlled chemical Numerical integration and Monte Carlo methods, numerical integration one and multi dimensional integrals, Monte carlo error, non uniform probability distributions, neutron transport, importance sampling, Metropolis Montecarlo method, error estimates for numerical integration, acceptance-rejection method, al reactions random number sequences.

Unit IV:

Percolation, cluster labeling, critical exponents and finite size scaling, renormalization group. Fractal dimension, Regular fractals and growth processes, fractala and chaos.

Unit V:

Micro canonical ensemble, Demon alogorithm, one dimensional classical ideal gas, the temperature and the canonical ensemble, Ising model, Heat flow, relation of the mean energy to the temperature. Monte carlo simulation of canonical ensemble, Metropolis algorithm, verification of Boltzman distribution, Ising model, Ising phase transition, applications of Ising model, simulation aof classical fluids, optimized Monte Carlo data analysis, other ensembles, fluctuation in the canonical ensemble, exact enumeration of the 2 x 2 Ising model.

TEXT BOOK:

1. Harvey Gould and Jan Tobochnik, 1996. An Introduction to Computer simulation methods (Application to Physical systems) – II edition , Addison-Wesley Publishing Company
   Unit 1: Pages 1-36, 95-126 , Unit 2: Pages 127-212 , Unit 3: Pages 343-405
   Unit 4: Pages 413-500, Unit 5: Pages 543-625

REFERENCE BOOKS:

Web Resources:

1. https://en.wikipedia.org/wiki/Computer_simulation
2. https://en.wikipedia.org/wiki/Variational_Monte_Carlo
3. https://en.wikipedia.org/wiki/Numerical_integration
4. https://en.wikipedia.org/wiki/Ising_model

Lecture Schedule

	Topic	No.of Lecture hrs.
1.1	Importance of Computers in Physics – Nature of Computer Simulation – Importance of Graphics – Programming Languages	5
1.2	Euler Algorithm – Example Coffee Cooling problem – Accuracy and stability – Visualization – Nuclear decay	5
1.3	Simple Harmonic Motion Motion – Numerical solution to simple harmonic oscillator of falling objects – Simple pendulum – Dissipative systems – Response to external forces – Electrical circuit oscillations	5
2.1	Chaotic motion of dynamical systems – periodic doubling – measuring and controlling chaos – Forced damped pendulum – Hamiltonian chaos	5
2.2	Perspective – Order – disorder – Poisson distribution and nuclear decay - introduction to0 random walks	5
2.3	Problems in probability – method of least squares – Simple variational Monte Carlo method – Random walks and diffusion equations..	5
3.1	Random walks, modified random walks, application to polymers, diffusion controlled chemical Numerical integration and Monte Carlo methods	5
3.2	numerical integration one and multi dimensional integrals, Monte carlo error, non uniform probability distributions, neutron transport, importance sampling	6
3.3	Metropolis Montecarlo method, error estimates for numerical integration, acceptance-rejection method, al reactions random number sequences.	6
4.1	Percolation, cluster labeling, critical exponents and finite size scaling	5
4.2	renormalization group. Fractal dimension, Regular fractals and growth processes, fractala and chaos.	6
5.1	Micro canonical ensemble, Demon alogorithm, one dimensional classical ideal gas, the temperature and the canonical ensemble, Ising model, Heat flow, relation of the mean energy to the temperature.	6
5.2	Monte carlo simulation of canonical ensemble, Metropolis algorithm, verification of Boltzman distribution, Ising model, Ising phase transition, applications of Ising model, simulation aof classical fluids,	6
5.3	optimized Monte Carlo data analysis, other ensembles, fluctuation in the canonical ensemble, exact enumeration of the 2 x 2 Ising model.	5

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined M.Sc. Physics on or after June 2019)
PROGRAMME CODE : PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH19C21	**SOLID STATE PHYSICS – I**	**Core 4**	**4**	**1**		**4**

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

Preamble

- Realize fundamentals of solid structure of materials.
- Confer the properties of phonons.
- Impart the knowledge of free electron Fermi gas.
- Get exposed to semiconductor energy bands and the methods of calculation.

Prerequisite

Strong knowledge on structure of materials and its classifications

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Acquire knowledge on basic concepts to describe the crystal structures and the reciprocal lattice vectors.	K1, K2
CO2	Perform calculations of Madelung constant in ionic crystals, discuss about covalent crystals, metals and elastic constants.	K1, K5
CO3	Discuss the properties of phonons and Debye /Einstein model of specific heat capacity.	K4
CO4	Summarize Free electron Fermi gas in three dimensions, nearly free electron model and Bloch functions.	K1
CO5	Understand the properties of semiconductors, theory of Fermi surfaces and to calculate energy bands by Tight binding method, Wigner – Seitz method, etc…	K2, K3

K1: Knowledge K2: Understand K3: Apply K4:Analyse K5: Evaluate

Mapping of COs with POs

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

Blooms taxonomy

Blooms Taxonomy			
Category	Continuous Assessment		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	20%	20%	20%
Understand -K2	20%	20%	20%
Apply-K3	20%	20%	20%
Analyze-K4	20%	20%	20%
Evaluate-K5	20%	20%	20%
Total Marks	**60**	**60**	**150**

Title of the paper

SOLID STATE PHYSICS – I

Unit I: CRYSTAL PHYSICS

Periodic arrays of atoms: Lattice translation vectors – Primitive lattice cell –Fundamental types of lattices: Two and three dimensional lattice types – Miller indices of crystal planes – Simple crystal structures : NaCl, CsCl, hcp, Diamond, Cubic ZnS – Bragg law – Fourier analysis – Reciprocal lattice vectors – Diffraction conditions – Laue equations – Brillouin zones : Reciprocal lattice to sc, bcc, fcc lattices – Structure factor of the bcc, fcc lattice.

Unit II: CRYSTAL BINDING AND ELASTIC CONSTANTS

Crystals of inert gases (van der Waals – London interaction) – Ionic crystals (Madelung constant) – Covalent crystals – Metals – Hydrogen bonds – Atomic radii – Analysis of Elastic constants – Elastic compliance and stiffness constants – Elastic waves in cubic crystals.

Unit III: PHONONS

Vibrations of crystals with mono atomic basis – Two atoms per primitive basis – Quantization of elastic waves (Phonons) – Phonon momentum – Inelastic scattering by phonons – Phonon heat capacity : Planck distribution, Density of states in one and three dimension – Debye and Einstein model of specific heat capacity.

Unit IV: FREE ELECTRON FERMI GAS & ENERGY BANDS

Energy levels in one dimension – Fermi – Dirac distribution for a free electron gas – Free electron gas in three dimensions – Heat capacity of the electron gas - Nearly free electron model: Origin and magnitude of energy gap – Bloch functions – Kronig – Penny model – Wave equation of an electron in a periodic potential: Bloch theorem, crystal momentum.

Unit V: SEMICONDUTORS, FERMI SURFACES AND METALS

Semiconductors: Band gap – Equations of motion – Holes and effective mass – Physical interpretation of the effective mass – Effective masses in semiconductors – Intrinsic carrier concentration, Impurity conductivity- Calculation of energy bands: Tight binding method – Wigner – Seitz method – Cohesive energy – Pseudopotential methods – Experimental methods: Quantization of orbits in a magnetic field – De Haas – van Alphen effect.

TEXT BOOK:

1. Kittel, C. 1996.Introduction to Solid State Physics ,VII ed, John Wiley & Sons, ISBN : 81 – 265 – 1045 – 5
   Unit – I Chapter- 1 & 2;Unit – II Chapter- 3;Unit – III Chapters- 4 & 5
   Unit – IV Chapters- 6 & 7; Unit – V Chapters- 8 & 9

REFERENCE BOOKS:

1. Myers, H.P. 1998.Introductory Solid State Physics , II ed., Viva Low – priced Student Edition, Viva Books Pvt. Ltd,
2. Omar, M. A. 2006. Elementary Solid State Physics , Pearson Education, , ISBN 81- 7758-377-8

3. Ibach, H. & Luth, H. 1991.Solid State Physics – An Introduction to Theory and Experiment, Narosa Publishing House,
4. Pillai, S.O. 1997, Solid State Physics 4th Ed., New Age International Publisher, ISBN:81-224-1048-0.
5. Srivatsava, J.P. 2007 Elements of Solid State Physics , II ed, Phi Publishers, ISBN 978-81-203-2847-1.

Web Resources:

1. https://en.wikipedia.org/wiki/Reciprocal_lattice
2. https://en.wikipedia.org/wiki/Debye_model
3. https://en.wikipedia.org/wiki/Bloch_wave
4. https://en.wikipedia.org/wiki/Tight_binding

Course Designers:

1. Mr.M.Venkatachalam
2. Dr.R.Srinivasan

Lecture Schedule

	Topic	No.of Lecture hrs.
1.1	Periodic arrays of atoms: Lattice translation vectors – Primitive lattice cell – Fundamental types of lattices: Two and three dimensional lattice types – Miller indices of crystal planes	5
1.2	Simple crystal structures : NaCl, CsCl, hcp, Diamond, Cubic ZnS – Bragg law – Fourier analysis – Reciprocal lattice vectors	5
1.3	Diffraction conditions – Laue equations – Brillouin zones : Reciprocal lattice to sc, bcc, fcc lattices – Structure factor of the bcc, fcc lattice.	5
2.1	Crystals of inert gases (van der Waals – London interaction) – Ionic crystals (Madelung constant)	5
2.2	Covalent crystals – Metals – Hydrogen bonds – Atomic radii – Analysis of Elastic constants	5
2.3	Elastic compliance and stiffness constants – Elastic waves in cubic crystals.	5
3.1	Vibrations of crystals with mono atomic basis – Two atoms per primitive basis – Quantization of elastic waves (Phonons)	5
3.2	Phonon momentum – Inelastic scattering by phonons – Phonon heat capacity : Planck distribution	5
3.3	Density of states in one and three dimension – Debye and Einstein model of specific heat capacity.	5
4.1	Energy levels in one dimension – Fermi – Dirac distribution for a free electron gas – Free electron gas in three dimensions	5
4.2	Heat capacity of the electron gas - Nearly free electron model: Origin and magnitude of energy gap – Bloch functions – Kronig – Penny model	5
4.3	Wave equation of an electron in a periodic potential: Bloch theorem, crystal momentum.	5
5.1	Semiconductors: Band gap – Equations of motion – Holes and effective mass – Physical interpretation of the effective mass – Effective masses in semiconductors	5
5.2	Intrinsic carrier concentration, Impurity conductivity- Calculation of energy bands: Tight binding method – Wigner – Seitz method	5
5.3	Cohesive energy – Pseudopotential methods – Experimental methods: Quantization of orbits in a magnetic field – De Haas – van Alphen effect.	5

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined M.Sc. Physics on or after June 2019)
PROGRAMME CODE : PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH19C22	**ELECTROMAGNETIC THEORY**	**Core 5**	**4**	**1**		**4**

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

Preamble

- Deal with the fundamental principles of electrostatics, magnetostatics and electrodynamics.
- Get familiarize with the application of Maxwell's equations to physical situations and propagation of electromagnetic waves in conducting media.
- Realize the essential principles of electrodynamics and its applications.

Prerequisite

Previous knowledge on vector calculus, electricity, magnetism and Maxwell's relations

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Understand the concepts on electrostatics and to use Gauss`s law in various applications.	K1, K2
CO2	Analyze the theory of magnetostatics –viz Biot-Savort`s law, Ampere`s circuital law and magnetic vector potential.	K1, K4
CO3	Derive Maxwell`s equation in differential and integral form, propagation of EM waves through different media	K5
CO4	Acquire the knowledge of the various modes of propagation of EM waves in waveguides.	K1
CO5	Discuss about Retarded potentials ,the Lienard – Wiechert potentials and Electric– Magnetic dipole radiation.	K2, K3

K1: Knowledge K2: Understand K3: Apply K4:Analyse K5: Evaluate

Mapping of COs with POs

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

Blooms taxonomy

Blooms Taxonomy			
Category	**Continuous Assessment**		**End of Semester Marks**
	I Internal Marks	**II Internal Marks**	
Knowledge -K1	20%	20%	20%
Understand -K2	20%	20%	20%
Apply-K3	20%	20%	20%
Analyze-K4	20%	20%	20%
Evaluate-K5	20%	20%	20%
Total Marks	**60**	**60**	**150**

Title of the paper

ELECTROMAGNETIC THEORY

Unit I: ELECTROSTATICS

Electric charge – Coulomb's law – Electric field – Electrostatic potential – Gauss law and its applications – The electric dipole – Multipole expansion of electric fields. Poisson's equation – Laplace's equation : Properties of solutions (Uniqueness theorem) – Solutions to Laplace's equation in spherical coordinates (Zonal harmonics) – Usefulness of zonal harmonics (conducting sphere in a uniform electric field) – Electrostatic images – Point charge and conducting sphere – Line charges and line images.

Unit II: MAGNETOSTATICS

Definition of magnetic induction – Forces on current carrying conductors – Biot – Savart Law – Elementary applications of Biot – Savart law – Ampere's circuital law – Magnetic vector potential – The magnetic field of a distant circuit – Magnetic scalar potential – Magnetic flux.

Unit III: MAXWELL'S EQUATIONS

Displacement current – Maxwell's equations: equation, derivation of differential and integral forms – Poynting theorem – Poynting vector - electromagnetic waves in free space, isotropic dielectrics and conducting media.

Unit IV: ELECTROMAGNETIC WAVES

Boundary conditions: reflection and transmission - Reflection and transmission of electromagnetic waves at normal and oblique incidence – Guided waves: Waveguides – TE waves in a rectangular waveguide.

Unit V: POTENTIALS AND RADIATION

Gauge transformations – Coulomb gauge and Lorentz gauge – Retarded potentials – The Lienard – Wiechert potentials – the fields of a moving point charge – Electric dipole radiation – Magnetic dipole radiation – Radiation from an arbitrary source.

TEXT BOOKS:

1. Reitz, J.R., Milford, F.J & Christy, R.W. 1998. Foundations of electromagnetic theory III ed., Narosa Publishing House, ISBN 81-85015-79-1. (For units I & II).
2. Chopra, K. K. Agarwal, G. C. 2010. Electromagnetic theory, V ed., K. Nath & Co., (For unit III)
3. David J. 2000. Griffiths. Introduction to Electrodynamics, III ed., Prentice Hall of India, ISBN 81-203-1601-0. (For units IV & V).

REFERENCE BOOKS:

1. Lorrain, P. & Corson, D.R. 2000. Electromagnetic Fields and Waves , II ed., CBS Publishers & Distributors.

2. Mukhopadhyay P, 1993. Electromagnetic Theory and Applications, Tata McGraw Hill, ISBN 0-07-460244-6.
3. Hayt Jr., W. H. Engineering Electromagnetics , V ed., McGraw Hill, 2001. ISBN 97- 8007-2524-956.
4. Capri, A.Z. & Panat, P.V. Introduction to Electrodynamics 2002. Narosa Publishing House, ISBN 81-7319-329-0.
5. Jordan, E.C. & Balmain, K.G., 2003. Electromagnetic Waves and Radiating Systems, II ed., Prentice – Hall of IndiaISBN 81-203-0054-8

Web Resources:

1. https://en.wikipedia.org/wiki/Poisson%27s_equation
2. https://en.wikipedia.org/wiki/Electromagnetic_wave_equation
3. https://en.wikipedia.org/wiki/Electrostatics
4. https://en.wikipedia.org/wiki/Biot%E2%80%93Savart_law

Course Designers:

1. Dr.R.V.Krishna Kumar
2. Dr. G.Arivazhagan

Lecture Schedule

	Topic	No.of Lecture hrs.
1.1	Electric charge – Coulomb's law – Electric field – Electrostatic potential – Gauss law and its applications – The electric dipole – Multipole expansion of electric fields.	6
1.2	Poisson's equation – Laplace's equation : Properties of solutions (Uniqueness theorem) – Solutions to Laplace's equation in spherical coordinates (Zonal harmonics)	6
1.3	Usefulness of zonal harmonics (conducting sphere in a uniform electric field) – Electrostatic images – Point charge and conducting sphere – Line charges and line images.	6
2.1	Definition of magnetic induction – Forces on current carrying conductors – Biot – Savart Law	5
2.2	Elementary applications of Biot – Savart law – Ampere's circuital law	6
2.3	Magnetic vector potential – The magnetic field of a distant circuit – Magnetic scalar potential – Magnetic flux.	6
3.1	Displacement current – Maxwell's equations: equation, derivation of differential and integral forms	6
3.2	Poynting theorem – Poynting vector- electromagnetic waves in free space, isotropic dielectrics and conducting media.	6
4.1	Boundary conditions: reflection and transmission - Reflection and transmission of electromagnetic waves at normal and oblique incidence	6
4.2	Guided waves: Waveguides – TE waves in a rectangular waveguide.	5
5.1	Gauge transformations – Coulomb gauge and Lorentz gauge	5
5.2	Retarded potentials – The Lienard – Wiechert potentials – the fields of a moving point charge	6
5.3	Electric dipole radiation – Magnetic dipole radiation – Radiation from an arbitrary source.	6

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined M.Sc. Physics on or after June 2019)
PROGRAMME CODE : PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH19C23	**QUANTUM MECHANICS – I**	**Core - 6**	**4**	**1**	**-**	**4**

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

Preamble

- Make the students to understand the concepts of quantum physics.
- Relate the knowledge of mathematics to the formalism of quantum mechanics.
- Launch applications of Quantum Mechanics in microscopic particle regime.

Prerequisite

Knowledge on Heissenberg's matrix mechanics, Schrodinger's wave mechanics and Dirac's Operator mechanics. Some Foundation on harmonic oscillator and quantum particle in a box.

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Illustrate the basic concepts of Schrodinger wave equation and its applications	K1
CO2	Heave light on the formulation of Schrodinger, Dirac and Heisenberg mechanics	K1, K2
CO3	Relate the knowledge of mathematics to the formalism of quantum mechanics	K2, K3
CO4	Acquire the basic knowledge on angular momentum of quantum mechanical systems	K1, K4
CO5	Have a glimpse of perturbation theory and its applications	K5

K1: Knowledge K2: Understand K3: Apply K4:Analyse K5: Evaluate

Mapping of COs with POs

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

Blooms taxonomy

Blooms Taxonomy			
Category	Continuous Assessment		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	20%	20%	20%
Understand -K2	20%	20%	20%
Apply-K3	20%	20%	20%
Analyze-K4	20%	20%	20%
Evaluate-K5	20%	20%	20%
Total Marks	**60**	**60**	**150**

Title of the paper

QUANTUM MECHANICS – I

Unit I: EQUATION OF MOTION OF MATTER WAVES

Time independent Schrodinger equation – Schrodinger equation for a free particle – Time dependent Schrodinger equation – Physical interpretation of wave function – Normalized and orthogonal wave functions – Solution of Schrodinger equation – Stationary state solution – Expectation values – Probability current density – Superposition of plane waves – Formulation of Schrodinger equation in momentum representation – Uncertainty principle – one dimensional square well potential – Linear Harmonic oscillator – Hydrogen atom.

Unit II: MATRIX FORMULATION OF QUANTUM MECHANICS

Matrix algebra – types of matrices – Hermitian and unitary matrices – Hilbert space – Dirac's bra and Ket notation - Physical meaning of matrix elements – Equations of motion – Schrodinger picture – Heisenberg picture – Interaction picture – Poisson brackets and Commutator brackets – Matrix theory of Harmonic oscillator.

Unit III : GENERAL FORMALISM OF QUANTUM MECHANICS

Linear operator-Eigen functions and Eigen values- Hermitian Operator-postulates of quantum mechanics- Dirac's notation- Equations of motion.

Unit IV: ANGULAR MOMENTUM STATES

Commutation relations for the generators – Choice of representation, Values of m, f(j), and □m. Angular momentum matrices (j = , j = 1 only) – Combination of Angular momentum states – Eigen values of the total Angular momentum – Clebsch Gordan coefficients – Recursion relations – Construction procedure – $j_1 = 1/2$, $j_2 = 1/2$

Unit V: APPROXIMATION METHODS FOR BOUND STATES

Stationary perturbation theory – non degenerate case – First order perturbation – Evaluation of first order Energy – Evaluation of first order correction to wave function –Zeeman effect without electron spin – First order stark effect in hydrogen atom – Variation method : Expectation value of the energy – Application to excited states – Ground State of Helium atom – Variation of the parameter Z.

Text Books:

1. Schiff, L.I., 1968, Quantum Mechanics , III ed., McGraw Hill, ISBN-0-07-085643-5.
2. Satyaprakash & Swati Satya , 2006, Quantum Mechanics , Kedar Nath Ram Nath & Co.
3. Aruldhas. J, Quantum Mechanics, Prentice – Hall of India, 2002, ISBN81- 203-1962.

References:

1. Mathews, P.M. & Venkatesan, K., 1978. A Text Book of Quantum Mechanics, Tata McGrawHill, ISBN 0-07-096510-2.
2. Bransden, B.H. & Joachain, C.J. 2005. Quantum Mechanics , II ed., PearsonEducation, ISBN 81-297-0470-6.

3. Merzbacher, E. 2004. Quantum Mechanics,III ed., John Wiley, ISBN9971- 51-281-5.
4. Ghatak, A.1996. Introduction to Quantum Mechanics :, Macmillan, ISBN0333- 92419.

Web Resources:

1. https://en.wikipedia.org/wiki/Matter_wave
2. https://en.wikipedia.org/wiki/Matrix_mechanics
3. web.mst.edu/~parris/QuantumTwo/Class_Notes/GeneralFormulation.pdf
4. www.damtp.cam.ac.uk/user/tong/aqm/aqmsix.pdf

Course Designers:

1. Dr.R.Vijayalakshmi
2. Dr.N.Srinivasan

Lecture Schedule

	Topic	No.of Lecture hrs.
1.1	Time independent Schrodinger equation – Schrodinger equation for a free particle – Time dependent Schrodinger equation – Physical interpretation of wave function – Normalized and orthogonal wave functions	5
1.2	Solution of Schrodinger equation – Stationary state solution – Expectation values – Probability current density – Superposition of plane waves – Formulation of Schrodinger equation in momentum representation	5
1.3	Uncertainty principle – one dimensional square well potential – Linear Harmonic oscillator – Hydrogen atom	5
2.1	Matrix algebra – types of matrices – Hermitian and unitary matrices – Hilbert space – Dirac's bra and Ket notation	5
2.2	Physical meaning of matrix elements – Equations of motion – Schrodinger picture	5
2.3	Heisenberg picture – Interaction picture – Poisson brackets and Commutator brackets – Matrix theory of Harmonic oscillator	5
3.1	Linear operator-Eigen functions and Eigen values	5
3.2	Hermitian Operator-postulates of quantum mechanics	5
3.3	Dirac's notation- Equations of motion	5
4.1	Commutation relations for the generators – Choice of representation, Values of m, f(j), and □m	5
4.2	Angular momentum matrices (j = ., j = 1 only) – Combination of Angular momentum states – Eigen values of the total Angular momentum	5
4.3	Clebsch Gordan coefficients – Recursion relations – Construction procedure – $j_1 = 1/2$, $j_2 = ½$	5
5.1	Stationary perturbation theory – non degenerate case – First order perturbation – Evaluation of first order Energy	5
5.2	Evaluation of first order correction to wave function –Zeeman effect without electron spin – First order stark effect in hydrogen atom	5
5.3	Variation method : Expectation value of the energy – Application to excited states – Ground State of Helium atom – Variation of the parameter Z	5

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined M.Sc. Physics on or after June 2019)
PROGRAMME CODE : PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH19CE21A	**MATHEMATICAL PHYSICS – II**	**Elective - 2**	**4**	**1**	**-**	**5**

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

Preamble

- Impart a thorough knowledge about elements of complex analysis.
- Guide the students in Fourier series and Transforms and enable them to solve physics problems.
- Provide involvement to understand about integral Transforms.

Prerequisite

Firm understanding of basic concepts of groups and complex numbers.

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Instruct about basic properties of complex functions and related theorems	K1, K2
CO2	Inculcate about basic properties of complex variables and related theorems	K1, K3
CO3	Grasp the idea of group theory and its implications	K5
CO4	Develop knowledge on the basic concepts on Laplace transform	K4
CO5	Gain knowledge on the basic concepts on Fourier series	K1, K5

K1: Knowledge K2: Understand K3: Apply K4:Analyse K5: Evaluate

Mapping of COs with POs

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

Blooms taxonomy

Blooms Taxonomy			
Category	Continuous Assessment		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	20%	20%	20%
Understand -K2	20%	20%	20%
Apply-K3	20%	20%	20%
Analyze-K4	20%	20%	20%
Evaluate-K5	20%	20%	20%
Total Marks	**60**	**60**	**150**

Title of the paper

MATHEMATICAL PHYSICS – II

Unit I: COMPLEX VARIABLES-I

Function of a complex variable-analytic functions-Necessary and sufficient condition for a function to be analytic (CR equations) – Laplace's equation: Harmonic functions – Line integral of a complex function – Cauchy's integral theorem (elementary proof and Goursat's proof: lemma I) – Cauchy's Integral formula – Derivatives of an analytic function – Taylors series – Laurent's series.

Unit II:COMPLEX VARIABLES-II

Singularities of an analytic function – Residues and their evaluation – Cauchy's residue theorem – Evaluation of definite integrals: integration round the unit circle – Evaluation of improper real integrals – evaluation of infinite integrals by Jordan's lemma – evaluation of infinite integrals when the integrand has poles on real axis.

Unit III: GROUP THEORY REPRESENTATION

Representation of groups – reducible and irreducible representations –some important theorems on representations – The orthogonality theorem – Character of a representation: character tables – The unitary group – Point groups.

UnitIV: LAPLACE TRANSFORMS

Laplace transforms-Properties of Laplace transforms – Laplace transform of derivative of a function-Laplace transform of integrals -Inverse Laplace theorem-properties of LT- Convolution or Faltung theorem

Unit V: FOURIER SERIES AND FOURIER TRANSFORM

Fourier series- Dirichlet's theorem and Dirichlet's conditions--change of interval from $(-\pi,\pi)$ to $(-l, l)$-Complex form of Fourier series-Fourier series in the interval $(0,T)$-change of interval from $(0, T)$ to $(0, 2l)$-Physical examples of Fourier series (Full wave rectifier, square wave and saw tooth wave). Fourier transform-Properties of Fourier transform(properties 1 to 7 and property 9)-Fourier transform of a derivative-Fourier sine and cosine transforms-Finite Fourier transforms-Applications of Fourier transforms

Text Books:

1. Satya Prakash, 2005. Mathematical Physics with Classical mechanics , IV ed., S. Chand & Sons,ISBN:81-7014-925-8.
   UNIT I: Chapter 5 [sec 5.7, 5.9-5.12, 5.14, 5.16, 5.17, 5.20, 5.21]
   UNIT II: Chapter 5[5.22-5.24, 5.25(a), 5.25(b), 5.25(c), 5.25(d)]
   UNIT III: Chapter 12[12.18-12.24]
   UNIT IV: Chapter 9 [9.9-9.12, 9.15, 9.17]
   UNIT V: Chapter 7[7.1-7.6, 7.8] and Chapter 9 [9.2-9.5, 9.7, 9.8].

References:

1. Gupta, B.D, 1993. Mathematical Physics, II ed.,Vikas Publishing House, ISBN:0-7069-76-4.
2. Weber, H.J. & Arfken, G.B. 2004. Essential Mathematical Methods for Physicists,Academic Press, ISBN:0-12-059878-7.
3. Riley, K.F., Hobson, M.P.& Bence, S.J.2004. Mathematical Methods for Physics and Engineering , II ed, Cambridge, ISBN:0-521-61296-9.
4. Ghatak, A.K.,Goyal, I.C. & Chua, S.J.2002. Mathematical Physics – Differential Equations and Transform Theory, Macmillan, ISBN:0-333-92548-3.
4. Tinkham, M. Group Theory & Quantum Mechanics, Tata McGraw Hill.

Web Resources:

1. *https://www.britannica.com/science/complex-variable*
2. https://en.wikipedia.org/wiki/Group_representation
3. https://en.wikipedia.org/wiki/Laplace_transform
4. *rundle.physics.ucdavis.edu/PHYGEO30/Fourier_Transforms.pdf*

Course Designers:

1. Dr. V.Rajniswami
2. Dr. S.Rajakarthihan

Lecture Schedule

	Topic	No.of Lecture hrs.
1.1	Function of a complex variable-analytic functions-Necessary and sufficient condition for a function to be analytic (CR equations)	5
1.2	Laplace's equation: Harmonic functions – Line integral of a complex function – Cauchy's integral theorem (elementary proof and Goursat's proof: lemma I)	5
1.3	Cauchy's Integral formula – Derivatives of an analytic function – Taylors series – Laurent's series	5
2.1	Singularities of an analytic function – Residues and their evaluation – Cauchy's residue Theorem	5
2.2	Evaluation of definite integrals: integration round the unit circle – Evaluation of improper real integrals	5
2.3	Evaluation of infinite integrals by Jordan's lemma – evaluation of infinite integrals when the integrand has poles on real axis	5
3.1	Representation of groups – reducible and irreducible representations –some important theorems on representations	5
3.2	The orthogonality theorem – Character of a representation: character tables	5
3.3	The unitary group – Point groups	5
4.1	Laplace transforms-Properties of Laplace transforms	5
4.2	Laplace transform of derivative of a function- Laplace transform of integrals	5
4.3	Properties of LT- Convolution or Faltung theorem	5
5.1	Fourier series- Dirichlet's theorem and Dirichlet's conditions--change of interval from $(-\pi,\pi)$ to (-l, l) - Complex form of Fourier series-Fourier series in the interval (0,T)	5
5.2	Change of interval from (0, T) to (0, 2l)-Physical examples of Fourier series (Full wave rectifier, square wave and saw tooth wave). Fourier transform-Properties of Fourier transform(properties 1 to 7 and property 9)	5
5.3	Fourier transform of a derivative-Fourier sine and cosine transforms-Finite Fourier transforms-Applications of Fourier transforms	5

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined M.Sc. Physics on or after June 2019)
PROGRAMME CODE: PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH19CE21B	**MOLECULAR BIOPHYSICS**	**Core - 2**	**4**	**1**		**4**

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

Preamble

- Acquire the Knowledge of the fundamentals of proteins and nucleic acids.
- Understand the spectroscopic techniques involved in the elucidation of structures of molecules.
- Appreciate techniques such as NMR, Laser and Holography.
- Know the principles and facts of the biological effects of radiation.

Prerequisite

Firm understanding of amino acids, nucleic acids and spectroscopic techniques

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Provide the fundamental knowledge on the structure and dynamics of Protein	K1, K2
CO2	Recognize the underlying physical principles of Nucleic acid and families	K1, K3
CO3	Gain knowledge about the design and functioning of spectroscopic techniques	K5
CO4	Providing phenomenological theories on NMR, LASER and Holography	K4
CO5	Acquire knowledge about radiation Biophysics	K1, K5

K1: Knowledge K2: Understand K3: Apply K4:Analyse K5: Evaluate

Mapping of COs with POs

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

Blooms taxonomy

Blooms Taxonomy			
Category	Continuous Assessment		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	20%	20%	20%
Understand -K2	20%	20%	20%
Apply-K3	20%	20%	20%
Analyze-K4	20%	20%	20%
Evaluate-K5	20%	20%	20%
Total Marks	**60**	**60**	**150**

Title of the paper

MOLECULAR BIOPHYSICS

Unit I: PROTEINS Proteins : Amino acids – Structural Organisation of Proteins – Globular and Fibrous Proteins – Dynamics of Protein-folding – Protein Engineering.

Unit II: NUCLEIC ACIDS Nucleic Acids: Nucleic Acids – Principle of Base-pairing/Base stacking – Nucleic acid Families – Protein Ligand Interactions.

Unit III: SPECTROSCOPIC TECHNIQUES IN STRUCTURE DETERMINATION Rayleigh Scattering – Diffusion – Sedimentation – Osmosis – Viscosity – Chromatography and Electrophoresis – Optical Activity – Absorption spectroscopy – UV, IR, Raman, ESR and Mossbauer Spectroscopy.

Unit IV: NUCLEAR MAGNETIC RESONANCE, LASERS AND HOLOGRAPHY One-dimensional – Multidimensional NMR Spectroscopy – Applications – Biomedical NMR. Lasers – Holography.

Unit V: RADIATION BIOPHYSICS Ionising Radiation – Interaction of Radiation with Matter – Measurement of Radiation (Dosimetry) Radioactive Isotopes – Biological Effects of Radiation – Radiation Protection and Therapy.

TEXT BOOK:

1. Narayanan, P. 1998. Essentials of Biophysics , New Age International Publishers, New Delhi,

Web Resources:

1. 1. https://www.particlesciences.com/news/technical-briefs/2009/protein-structure.html
2. *https://www.jeol.co.jp › ... › Nuclear Magnetic Resonance Spectrometer (NMR)*

Course Designers:

1. Dr.R.V.Krishna Kumar

Lecture Schedule

	Topic	No.of Lecture hrs.
1.1	Proteins : Amino acids – Structural Organisation of Proteins	5
1.2	Globular and Fibrous Proteins	5
1.3	Dynamics of Protein-folding – Protein Engineering.	5
2.1	Nucleic Acids: Nucleic Acids – Principle of Base-pairing	8
2.2	Base stacking – Nucleic acid Families – Protein Ligand Interactions.	7
3.1	Rayleigh Scattering – Diffusion – Sedimentation	5
3.2	Osmosis – Viscosity – Chromatography and Electrophoresis	5
3.3	Optical Activity – Absorption spectroscopy – UV, IR, Raman, ESR and Mossbauer Spectroscopy.	5
4.1	One-dimensional – Multidimensional NMR Spectroscopy – Applications	5
4.2	Biomedical NMR.	5
4.3	Lasers – Holography.	5
5.1	Ionising Radiation – Interaction of Radiation with Matter	5
5.2	Measurement of Radiation (Dosimetry) Radioactive Isotopes – Biological Effects of Radiation	5
5.3	Radiation Protection and Therapy.	5

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined M.Sc. Physics on or after June 2019)
PROGRAMME CODE : PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH19C31	**SOLID STATE PHYSICS – II**	**Core 7**	**4**	**1**		**4**

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

Preamble

- Recognize the different types of magnetic materials and Magnetic Resonance.
- Identify the fundamentals of solid state particles viz., Plasmons, Polaritons, Polarons an excitons.
- Realize dielectrics and ferroelectrics by classical and quantum treatment.
- Know different types of defects and dislocations in crystals.

Prerequisite

Basic knowledge on dielectrics and magnetism.

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	gain knowledge on the nature of diamagnetic and paramagnetic materials	K1, K2
CO2	discuss the basic concepts of ferromagnetism and to analyze nuclear magnetic resonance.	K1, K3
CO3	Summarize the essentials of the solid state particles Plasmons, Polaritons, excitons and about Raman effect in crystals	K2
CO4	Compare the dielectric and ferroelectric nature of materials.	K5
CO5	Analyze various types of point defects (schottky, frenkel) and dislocations occurring in crystals.	K2, K4

K1: Knowledge K2: Understand K3: Apply K4:Analyse K5: Evaluate

Mapping of COs with POs

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

Blooms taxonomy

Blooms Taxonomy			
Category	Continuous Assessment		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	20%	20%	20%
Understand -K2	20%	20%	20%
Apply-K3	20%	20%	20%
Analyze-K4	20%	20%	20%
Evaluate-K5	20%	20%	20%
Total Marks	**60**	**60**	**150**

Title of the paper SOLID STATE PHYSICS – II

Unit I: DIAMAGNETISM AND PARAMAGNETISM

Diamagnetism: Langevin diamagnetism equation –Quantum theory of diamagnetism of mononuclear systems –**Paramagnetism**: Quantum theory of paramagnetism: Rare earth ions – Hund rules – Iron group ions – Crystal field splitting – Quenching of the orbital angular momentum –Cooling by isentropic demagnetization: Nuclear demagnetization – Paramagnetic susceptibility of conduction electrons.

Unit II: FERROMAGNETISM AND MAGNETIC RESONANCE

Ferromagnetism: Ferromagnetic order: Curie point and the exchange integral (Curie-Weiss law, Heisenberg model, Exchange energy) –Magnons: Quantization of spin waves– Thermal excitation of magnons – Ferromagnetic domains: Anisotropy energy – Transition region between domains – Origin of domains – Coercivity and Hysteresis – **Magnetic Resonance:**Nuclear magnetic resonance: Equations of motion – Line width – Motional narrowing – Hyperfine splitting – Examples: paramagnetic point defects – knight shift

Unit III: PLASMONS, POLARITONS, POLARONS AND EXCITONS

Plasmons: Electrostatic screening: Screened Coulomb potential, Pseudopotential component U(O), Mott metal-insulator transition, Screening and phonons in metals. **Polaritons:** Lyddane-Sachs-Teller (LST) relation. Electron-electron interaction: Fermi liquid – Electron – electron collisions –Electron – phonon interactions: **Polarons.Excitons:** Frenkel excitons – Alkali halides – Molecular crystals – Weakly bound (Mott-Wannier) excitons – Exciton condensation into electron-hole drops (EHD). Raman effect in crystals.

Unit IV: DIELECTRICS AND FERROELECTRICS

Dielectrics: Macroscopic electric field: Depolarization field E_1 – Local electric field at an atom – Dielectric constant and polarizability (Clausius-Mossotti relation) – Electronic polarizability – Structural phase transition – **Ferroelectrics:** Ferroelectric crystals – Classifications of ferroelectric crystals – Displacive transitions – Soft optical phonons – Anti-ferro electricity – Ferroelectric domains – Piezoelectricity.

Unit V: POINT DEFECTS AND DISLOCATIONS:

Point defects: Lattice vacancies (Schottky and Frenkel defects) – Diffusion – Color centers – F centers – Other centers in alkali halides. **Dislocations :**(Edge dislocation, Screw dislocation) – Burgers vectors – stress fields of dislocations – Low-angle grain boundaries – dislocation densities – dislocation multiplication and slip. Dislocation and crystal growth –Whiskers. Hardness of materials.

TEXT BOOK:

1. Kittel. C, 1996. Introduction to Solid State Physics, VII ed., John Wiley & Sons, ISBN: 81-265-1045-5.

Unit – I Chapter- 11; Unit – II Chapter- 12 &13;
Unit – III Chapters- 14 &15; Unit – IV Chapter- 16
Unit – V Chapters- 20 &21

REFERENCE BOOKS:

1. Myers, H.P. 1998.Introductory Solid State Physics, II ed., Viva Low – priced Student Edition, Viva Books Pvt. Ltd.
2. Omar, M. A. 2006. Elementary Solid State Physics, Pearson Education, , ISBN 81- 7758-377-8.
3. Ibach, H. & Luth,H. 1991.Solid State Physics – An Introduction to Theory and Experiment, Narosa Publishing House.
4. Pillai, S.O. 2007.Solid State Physics, revised VI Edition, New Age International
5. Srivatsava, J.P. 2007. Elements of Solid State Physics , II ed., Phi Publishers, , ISBN 978-81-203-2847-1.

Web Resources:

1. https://en.wikipedia.org/wiki/Ferroelectricity
2. https://en.wikipedia.org/wiki/Paramagnetism
3. https://en.wikipedia.org/wiki/Crystallographic_defect
4. https://en.wikipedia.org/wiki/Polariton

Course Designers:

1. Mr.M.Venkatachalam
2. Dr.R.Srinivasan

Lecture Schedule

	Topic	No.of Lecture hrs.
1.1	Diamagnetism:Langevin diamagnetism equation –Quantum theory of diamagnetism of mononuclear systems	5
1.2	Paramagnetism: Quantum theory of paramagnetism: Rare earth ions – Hund rules – Iron group ions	5
1.3	Crystal field splitting – Quenching of the orbital angular momentum – Cooling by isentropic demagnetization: Nuclear demagnetization – Paramagnetic susceptibility of conduction electrons.	5
2.1	Ferromagnetism: Ferromagnetic order: Curie point and the exchange integral (Curie-Weiss law, Heisenberg model, Exchange energy) – Magnons: Quantization of spin waves	5
2.2	Thermal excitation of magnons – Ferromagnetic domains: Anisotropy energy – Transition region between domains – Origin of domains – Coercivity and Hysteresis	5
2.3	Magnetic Resonance: Nuclear magnetic resonance: Equations of motion – Line width – Motional narrowing – Hyperfine splitting – Examples: paramagnetic point defects – knight shift	5
3.1	Plasmons: Electrostatic screening: Screened Coulomb potential, Pseudopotential component U(O), Mott metal-insulator transition, Screening and phonons in metals.	5
3.2	Polaritons: Lyddane-Sachs-Teller (LST) relation. Electron-electron interaction: Fermi liquid – Electron – electron collisions –Electron – phonon interactions.	5
3.3	Polarons.Excitons: Frenkel excitons – Alkali halides – Molecular crystals – Weakly bound (Mott-Wannier) excitons – Exciton condensation into	5

	electron-hole drops (EHD). Raman effect in crystals.	
4.1	Dielectrics: Macroscopic electric field: Depolarization field E_1 – Local electric field at an atom – Dielectric constant and polarizability (Clausius-Mossotti relation)	5
4.2	Electronic polarizability – Structural phase transition – Ferroelectrics: Ferroelectric crystals – Classifications of ferroelectric crystals.	5
4.3	Displacive transitions – Soft optical phonons – Anti-ferro electricity – Ferroelectric domains – Piezoelectricity	5
5.1	Point defects: Lattice vacancies (Schottky and Frenkel defects) – Diffusion – Color centers – F centers – Other centers in alkali halides.	5
5.2	Dislocations:(Edge dislocation, Screw dislocation) – Burgers vectors – stress fields of dislocations – Low-angle grain boundaries – dislocation densities	5
5.3	Dislocation multiplication and slip. Dislocation and crystal growth – Whiskers. Hardness of materials.	5

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined M.Sc. Physics on or after June 2019)
PROGRAMME CODE : PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH19C32	**QUANTUM MECHANICS – II**	**Core - 8**	**4**	**1**	**-**	**4**

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

Preamble

- Understanding of advanced quantum mechanical concepts on perturbation, scattering and radiation.
- Acquire the knowledge in identical particles, its spin matrices and wave equations.
- Understand the formulation of relativistic wave equation.
- Get knowledge on the formulation of quantum field theory

Prerequisite

Firm knowledge on fundamentals of pertubation and scattering theory and to possess basic knowledge on transition probabilities.

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Realize the perturbation theory and its applications	K1, K2
CO2	Attain knowledge on approximation methods employed in solving quantum mechanical problems	K2, K3
CO3	Appreciate Advanced level of Quantum Mechanics	K5
CO4	comprehend the concepts of relativistic wave equations	K4
CO5	Acquire knowledge on the formulation of quantum field theory	K1, K5

K1: Knowledge K2: Understand K3: Apply K4:Analyse K5: Evaluate

Mapping of COs with POs

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

Blooms taxonomy

Blooms Taxonomy			
Category	Continuous Assessment		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	20%	20%	20%
Understand -K2	20%	20%	20%
Apply-K3	20%	20%	20%
Analyze-K4	20%	20%	20%
Evaluate-K5	20%	20%	20%
Total Marks	**60**	**60**	**150**

Title of the paper

QUANTUM MECHANICS – II

Unit I: TIME DEPENDENT QUANTUM APPROXIMATIONS

Time-Dependent perturbation theory – First order perturbation – Perturbation constant in time – Physical significance – Transition probability – Fermi's golden rule – Harmonic perturbation – Adiabatic approximation – Sudden approximation.

Unit II: QUANTUM THEORY OF SCATTERING

General Formulation of Scattering Theory Born Approximation – Condition for validity of Born Approximation – Scattering by a screened coulomb potential: Rutherford's scattering formula from Born approximation – Partial wave analysis (Theory only).

Unit III: IDENTICAL PARTICLES AND SPIN

Identical particles – Physical meaning of identify – Symmetric and antisymmetric wave functions – Construction from unsymmetrized function – Distinguishability of identical particles – Exclusion principle – Connection with statistical mechanics – Paulil's spin matrices for an electron and their properties – Electron spin matrices for an electron and their properties – Electron spin functions – Symmetric and antisymmetric wave function of a hydrogen molecule.

Unit IV: RELATIVISTIC WAVE EQUATIONS

Schrodinger's relativistic equation for a free particle – Klien-Gordon equation – E.M. potentials – Separation of the equation – Energy levels in a Coulomb field – Dirac's relativistic equation – Dirac matrices – Free particles solution – Charge and current densities – Magnetic moment of the electron – Spin angular momentum of the electron – Approximate reduction (spin-orbit energy) – Negative energy states.

Unit V: QUANTUM THEORY OF RADIATION

Transition probability for emission and absorption – Einstein's coefficients in a radiation field – Einstein's transition probabilities for absorption and emission in a radiation field.

Text Books:

1. Schiff, L.I., 1968, Quantum Mechanics , III ed., McGraw Hill, ISBN-0-07-085643-5.
2. Satyaprakash & Swati Satya , 2006, Quantum Mechanics , Kedar Nath Ram Nath & Co.
3. Aruldhas. J, Quantum Mechanics, Prentice – Hall of India, 2002, ISBN81- 203-1962.

References:

1. Satyaprakash & Swati Satya 2006.Quantum Mechanics, Kedar Nath Ram Nath & Co
2. Mathews, P.M. & Venkatesan, K 1978. A Text Book of Quantum Mechanics , Tata McGraw Hill, ISBN 0-07-096510-2.
3. Aruldhas, J,2002.Quantum Mechanics. Prentice – Hall of India, ISBN 81-203-1962-1.

4. Bransden, B.H. & Joachain, C.J. 2005. Quantum Mechanics ,II ed, Pearson Education, ISBN 81-297-0470-6.
5. Merzbacher, E. 2004. Quantum Mechanics , III ed., John Wiley, ISBN 9971-51-281-5.
6. Ghatak, A. 1996.Introduction to Quantum Mechanics , Macmillan, SBN 0333-92419-3.

Web Resources:

1. https://www.lorentz.leidenuniv.nl/QT/exercises/QTclass_6.pdf
2. https://en.wikipedia.org/wiki/Scattering_theory
3. https://en.wikipedia.org/wiki/Identical_particles
4. *https://en.wikipedia.org/wiki/Klein–Gordon_equation*
5. *https://whatis.techtarget.com/definition/quantum-theory*

Course Designers:

1. Dr.N.Srinivasan
2. Mrs.R.Dhanalakshmi

Lecture Schedule

	Topic	No.of Lecture hrs.
1.1	Time-Dependent perturbation theory – First order perturbation – Perturbation constant in time	5
1.2	Physical significance – Transition probability – Fermi's golden rule – Harmonic perturbation	5
1.3	Adiabatic approximation – Sudden approximation	5
2.1	General Formulation of Scattering Theory Born Approximation –	5
2.2	Condition for validity of Born Approximation - Scattering by a screened coulomb potential :	5
2.3	Rutherford's scattering formula from Born approximation - Partial wave analysis (Theory only)	5
3.1	Identical particles – Physical meaning of identify – Symmetric and antisymmetric wave functions	5
3.2	Construction from unsymmetrized function – Distinguishability of identical particles – Exclusion principle – Connection with statistical mechanics – Paulil's spin matrices for an electron and their properties	5
3.3	Electron spin matrices for an electron and their properties – Electron spin functions – Symmetric and antisymmetric wave function of a hydrogen molecule	5
4.1	Schrodinger's relativistic equation for a free particle – Klien-Gordon equation – E.M. potentials – Separation of the equation	5
4.2	Energy levels in a Coulomb field – Dirac's relativistic equation – Dirac matrices – Free particles solution – Charge and current densities	5
4.3	Magnetic moment of the electron – Spin angular momentum of the electron – Approximate reduction (spin-orbit energy) – Negative energy states	5
5.1	Transition probability for emission and absorption	5
5.2	Einstein's coefficients in a radiation field	5
5.3	Einstein's transition probabilities for absorption and emission in a radiation field	5

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined M.Sc. Physics on or after June 2019)
PROGRAMME CODE : PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH19C33	**NUCLEAR PHYSICS**	**Core - 9**	**4**	**1**		**4**

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

Preamble

- Deliberate the fundamental concepts in Nuclear Physics.
- Appreciative the Theories involved in the nuclear forces and reactions
- Identify with various theories and mechanisms of radioactive decay.
- Appreciate the high energy neutron physics and elementary particles

Prerequisite

Elementary knowledge on nucleus, nucleus models, reactions and elementary particles.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Understand the basic structure and properties of nucleus including the nuclear shell model.	K1, K2
CO2	Develop the theory of nuclear forces and its experimental evidence	K1, K5
CO3	Acquire the knowledge of various nuclear decays and radioactivity	K2
CO4	Apply the knowledge of nuclear reactions for producing fission and Heavy ion reactions	K3
CO5	Classify the elementary particles, their interactions and Quarks.	K1, K4

K1: Knowledge K2: Understand K3: Apply K4:Analyse K5: Evaluate

Mapping of COs with POs

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

Blooms taxonomy

Blooms Taxonomy			
Category	**Continuous Assessment**		**End of Semester Marks**
	I Internal	**II Internal**	
Knowledge -K1	20%	20%	20%
Understand -K2	20%	20%	20%
Apply-K3	20%	20%	20%
Analyze-K4	20%	20%	20%
Evaluate-K5	20%	20%	20%
Total Marks	**60**	**60**	**150**

Title of the paper

NUCLEAR PHYSICS

Unit I: NUCLEUS

Nuclear size – Mirror nuclei – Elastic scattering of electrons by nuclei – Muonic X-rays – Electric multipole moments – Spheroidal nuclei – Nuclear magnetic moment – The Schmidt model – Nuclear shell Model: Magic numbers – The independent particle model Nuclear ground state configurations and spins – Low-lying energy levels.

Unit II: NUCLEAR FORCE

The short range force – General form of the nucleon-nucleon potential –Exchange forces – Meson theory of nuclear forces – Experimental evidence – Low energy nucleon-nucleon scattering.

Unit III: RADIOACTIVE DECAY

The Q-value for alpha decay- Coulomb potential barrier - One dimensional potential barrier problem – Gamow's theory of α-decay –alpha particle energy spectrum – Fermi's theory of beta decay – Classification of nuclear transitions – Parity violation in beta decay – Electric & magnetic multipole radiation – Selection rules for multipole radiation – Internal conversion – Nuclear isomers.

Unit IV: NUCLEAR REACTIONS

The compound nucleus model – The optical model – The direct reaction model: Deuteron pick-up reaction – Nuclear fission – Heavy ion reactions: Stability of heavy nuclei – the shell effects – quantum electrodynamics of strong fields.

Unit V: SUB-NUCLEAR PHYSICS

Proliferation of elementary particles - classification of elementary particles and their interactions – Short lived resonance states – Gellmann-Okuba mass formula – Quarks as building blocks of hadrons – Baryon magnetic moments – Discovery of heavier quarks – Colour degree of freedom.

TEXT BOOK:

1. Devanathan, V. 2006. Nuclear Physics, Narosa Publishing House, ISBN: 10-81-7319-704- 0.

REFERENCE BOOKS:

1. Roy, R.R. & Nigam, B.P. 1996. Nuclear Physics – Theory and Experiment, New Age International, ISBN 0-85226-788-6.
2. Krane, K.S. 1987. Introductory Nuclear Physics, John Wiley & Sons, ISBN: 97-80471-80553-3.
3. Heyde, K. 2005. Basic Ideas and Concepts in Nuclear Physics, II ed., Overseas Press, ISBN 81-88689-08-4.
4. Lilley, J. 2001. Nuclear Physics – Principles and Applications, John Wiley & Sons, ISBN 9-812-53004-5.
5. Krane, K.S. 1987.Introductory Nuclear Physics, John Wiley & Sons, ISBN: 9780471805533.

Web Resources:

1. https://brilliant.org/wiki/nuclear-decay/
2. https://en.wikipedia.org/wiki/Quark
3. https://en.wikipedia.org/wiki/Nuclear_force
4. https://en.wikipedia.org/wiki/Nuclear_shell_model

Course Designers:

1. Dr.R.V.Krishna Kumar
2. Dr. G.Arivazhagan

Lecture Schedule

	Topic	No.of Lecture hrs.
1.1	Nuclear size – Mirror nuclei – Elastic scattering of electrons by nuclei – Muonic X-rays – Electric multipole moments	5
1.2	Spheroidal nuclei – Nuclear magnetic moment – The Schmidt model –	5

	Nuclear shell Model: Magic numbers	
1.3	The independent particle model Nuclear ground state configurations and spins – Low-lying energy levels.	5
2.1	The short range force – General form of the nucleon-nucleon potential	5
2.2	Exchange forces – Meson theory of nuclear forces	5
2.3	Experimental evidence – Low energy nucleon-nucleon scattering.	5
3.1	The Q-value for alpha decay- Coulomb potential barrier - One dimensional potential barrier problem – Gamow's theory of α-decay – alpha particle energy spectrum	5
3.2	Fermi's theory of beta decay – Classification of nuclear transitions – Parity violation in beta decay	5
3.3	Electric & magnetic multipole radiation – Selection rules for multipole radiation – Internal conversion – Nuclear isomers.	5
4.1	The compound nucleus model – The optical model – The direct reaction model: Deuteron pick-up reaction	5
4.2	Nuclear fission – Heavy ion reactions: Stability of heavy nuclei	5
4.3	The shell effects – quantum electrodynamics of strong fields.	5
5.1	Proliferation of elementary particles - classification of elementary particles and their interactions	5
5.2	Short lived resonance states – Gellmann-Okuba mass formula – Quarks as building blocks of hadrons	5
5.3	Baryon magnetic moments – Discovery of heavier quarks – Colour degree of freedom	5

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined M.Sc. Physics on or after June 2019)
PROGRAMME CODE : PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH19C34	**MICROPROCESSOR AND MICROCONTROLLERS**	Core - 10	**4**	**1**	**-**	**4**

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

Preamble

- Realize the architecture of microprocessors and methodology of programming.
- Initiate the student able to use microprocessor in different applications.
- Make them to solve the arithmetic operations using microprocessor.
- Explore the interfacing using the microcontroller.

Prerequisite

Strong knowledge on algorithms, instruction sets and interfacing techniques.

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Familiar with the evolution of 8085 microprocessor	K1
CO2	Realize the architecture of microprocessors	K2 & K3
CO3	Work out the arithmetic operations using microprocessor	K3
CO4	Familiar with the evolution of microcontrollers	K5
CO5	Exercises the applications of microprocessor	K4, K5

K1: Knowledge K2: Understand K3: Apply K4:Analyse K5: Evaluate

Mapping of COs with POs

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

Blooms taxonomy

Blooms Taxonomy			
Category	Continuous Assessment		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	20%	20%	20%
Understand -K2	20%	20%	20%
Apply-K3	20%	20%	20%
Analyze-K4	20%	20%	20%
Evaluate-K5	20%	20%	20%
Total Marks	**60**	**60**	**150**

Title of the paper

MICROPROCESSOR AND MICROCONTROLLERS

Unit I:

Evolution of microprocessors-Various languages- Mnemonics- RAM-ROM- Main memory –secondary memory- buses- computers- large small network- LAN- CAD- voice recognition- AI-Block diagram of 8085- pin out diagram- Explanation- Registers- 8085 Instructions- Opcode- operand- words

Unit II:

Instruction cycle- fetch cycle- timing diagram – Machine cycle- T-states- opcode fetch operation- MVI, r data -memory read- Memory write- groups and instruction- explanation of various groups with examples- various addressing modes- stacks –PUSH operation- subroutine

Unit III:

ALP-simple program- 8 bit addition- timing diagram- 8 bit subtraction- sum 16 bits- 8bit decimal subtraction- one's complement of 16 bit number- Two's complement of 16 bit number-largest number in an array- smallest number in an array-Arrays in ascending order- arrays in descending order- square root of a number

Unit IV:

Single chip microcontrollers- intel 8051 series microcontrollers(MCS-51) –MCS151 and MCS 251 high performance CHMOS microcontrollers- Intel 8096 series microcontrollers (MCS96) –Brief description of Intel 8096 family members- 32 bit microcontrollers- Rupi44 family microcontroller with on-chip communication controller- I/O processor- co-processor

Unit V:

Microprocessor applications- speed of motor- stepper motor- traffic control- 8086 operating modes- status flags- registers-addressing modes- 8085/8086 CPU architecture- Execution unit- general registers- arithmetic and logic unit- flag registers- bus interface unit- instruction queue- instruction pointer- segment registers.

Text Books:

1. Ram, B. 1993. Microprocessor and its applications, IV edition, Dhanpat Rai publicationsLtd.
   Unit I Ch. 1.1, 5.1 to 5.3, 1.6, 1.7, 1.10 to 1.23, 3.1
   Unit II Ch. 3., 3.3, 4.1 to 4.3, 5.5, 5.63
   Unit III Ch. 6.1to 6.3, 6.5, 6.6, 6.10, 6.12, 6.21, 6.22, 6.24, 6.36
2. Badri Ram, 2001. Advanced Microprocessors and interfacing, Tata McGraw Hill Publishing Ltd., New Delhi ISBN: 0-07-043448-4
   Unit IV Ch. 6.1, 6.3 and 6.4
3. Srinath, N.K. 2012, 8085 Microprocessor programming and interfacing, PHI learning private limited, New Delhi.
   Unit V Ch.13.

References:

1. Aditya P. Mathur, 1985. Introduction to Microprocessors, 2nd Edition, Tata McGraw Hill Ltd., New Delhi.

Web Resources:

1. *www.zseries.in/.../8085%20microprocessor/history%20of%20microprocessor.php*.
2. *https://www.geeksforgeeks.org/instruction-cycle-8085-microprocessor/*.
3. *https://www.technicalsymposium.com/microprocessor_lab.pdf*.
4. *https://en.wikipedia.org/wiki/Intel_MCS-51*.
5. *https://www.quora.com/What-are-the-various-applications-of-microprocessors*.
6. https://en.wikipedia.org/wiki/Intel_8086.

Course Designers:

3. Dr. R.Vijayalakshmi
4. Dr. S.Rajakarthihan

Lecture Schedule

	Topic	No.of Lecture hrs.
1.1	Evolution of microprocessors-Various languages- Mnemonics- RAM-ROM- Main memory –secondary memory	5
1.2	buses- computers- large small network- LAN- CAD- voice recognition- AI	5
1.3	Block diagram of 8085- pin out diagram- Explanation- Registers- 8085 Instructions- Opcode- operand- words	5
2.1	Instruction cycle- fetch cycle- timing diagram – Machine cycle- T-states-opcode fetch operation	5
2.2	MVI, r data -memory read- Memory write- groups and instruction-explanation of various groups with examples	5
2.3	various addressing modes- stacks –PUSH operation- subroutine	5
3.1	ALP-simple program- 8 bit addition- timing diagram- 8 bit subtraction-sum 16 bits- 8bit decimal subtraction	5
3.2	one's complement of 16 bit number- Two's complement of 16 bit number-largest number in an array	5
3.3	smallest number in an array-Arrays in ascending order- arrays in descending order- square root of a number	5
4.1	Single chip microcontrollers- intel 8051 series microcontrollers(MCS-51) –MCS151 and MCS 251 high performance CHMOS microcontrollers	5
4.2	Intel 8096 series microcontrollers (MCS96) –Brief description of Intel 8096 family members	5
4.3	32 bit microcontrollers- Rupi44 family microcontroller with on-chip communication controller- I/O processor- co-processor	5
5.1	Microprocessor applications- speed of motor- stepper motor- traffic control- 8086 operating modes	5
5.2	status flags- registers-addressing modes- 8085/8086 CPU architecture-Execution unit- general registers	5
5.3	arithmetic and logic unit- flag registers- bus interface unit- instruction queue- instruction pointer- segment registers	5

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined M.Sc. Physics on or after June 2019)
PROGRAMME CODE : PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH19C41	**SPECTROSCOPY**	**Core 11**	**4**	**1**		**4**

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

Preamble

- Value the basis of various spectroscopy
- Derive the information of complex molecules from their spectra.
- Analyze and interpret spectroscopic data collected by the methods discussed in the course.
- Comprehend the principle behind the instrumentation for measurement.

Prerequisite

Detailed understanding of various principles involved in molecular spectra viz., rotation, vibration, electronic spectra and basic principles in Raman, NMR and ESR.

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Comprehend the aspects of Infrared spectroscopy and its instrumentation.	K1, K2
CO2	Brief about the basics of Raman spectroscopy , its Vibrational activity in various types of molecules.	K1, K3
CO3	understand the theory and principles of electronic spectroscopy	K2
CO4	Know the physics behind NMR spectroscopy and Fourier transform NMR spectroscopy.	K1
CO5	Analyze the theory of E.S.R. spectroscopy and the techniques behind it.	K4, K5

K1: Knowledge K2: Understand K3: Apply K4:Analyse K5: Evaluate

Mapping of COs with POs

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

Blooms taxonomy

Blooms Taxonomy			
Category	Continuous Assessment		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	20%	20%	20%
Understand -K2	20%	20%	20%
Apply-K3	20%	20%	20%
Analyze-K4	20%	20%	20%
Evaluate-K5	20%	20%	20%
Total Marks	**60**	**60**	**150**

Title of the paper

SPECTROSCOPY

Unit I: INFRARED SPECTROSCOPY

Energy of a diatomic molecule – simple harmonic oscillator – Anharmonic oscillator – diatomic vibrating rotator – vibrations of polyatomic molecules – fundamental vibrations and their symmetry – influence of rotations on the spectra of polyatomic molecules – linear molecules – symmetric top molecules – skeletal vibrations-group frequencies-techniques and instrumentation – double and single beam operation.

Unit II: RAMAN SPECTROSCOPY

Pure rotation Raman spectra – linear molecules – symmetric top molecules – vibrational Raman spectra – Raman activity of vibrations – rules of mutual exclusion overtone and combination – vibrational Raman spectra – rotational fine structure – nature of polarized light – vibration of spherical top molecules – techniques and instrumentation- the Fourier transform spectroscopy.

Unit III: ELECTRONIC SPECTROSCOPY OF MOLECULES

Electronic spectra of diatomic molecules- the Born-Oppenheimer Approximation vibrational Coarse Structure: Progressions- intensity of Vibrational-Electronic Spectra: the Franck-Condon Principle-Rotational fine structure of electronic-vibration transitions, electronic spectra of polyatomic molecules-change of shape of excitation-chemical analysis by electronic spectroscopy-the Re-emission of energy by an excited molecule, techniques and instrumentation.

Unit IV: NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY

The nature of spinning particles – Interaction between spin and a magnetic field – population of energy levels – Larmor precession and relaxation time – Fourier Transform spectroscopy in NMR – Chemical shift.

Unit V: ELECTRON SPIN RESONANCE SPECTROSCOPY

Introduction- position of E.S.R absorptions: the g-factor-hyperfine structure of E.S.R absorptions-double resonance in E.S.R- fine structure in E.S.R spectra- technique of E.S.R spectroscopy

TEXT BOOK:

1. Banwell, C. N. Mccash, E. M.Fundamentals of molecular spectroscopy, IV ed., Tata Mcgraw-Hill Education(India) Private Limited, New Delhi.

REFERENCE BOOKS:

1. Aruldhas, G. Molecular structure and spectroscopy, Prentice-Hall of India private Limited, New Delhi.
2. Sindhu, P. S. Molecular spectroscopy, Tata McGraw-Hill publishing company Limited, New Delhi.
3. Borrow, G.M. Introduction to Molecular Spectroscopy, McGraw-Hill Kogakusha Ltd, Tokyo. (for unit V)

Web Resources:

1. https://en.wikipedia.org/wiki/Infrared_spectroscopy
2. https://en.wikipedia.org/wiki/Raman_spectroscopy
3. https://en.wikipedia.org/wiki/Electron_spectroscopy
4. https://en.wikipedia.org/wiki/Nuclear_magnetic_resonance_spectroscopy

Course Designers:

1. Dr. G.Arivazhagan
2. Mrs.R.Sribala

Lecture Schedule

	Topic	No.of Lecture hrs.
1.1	Energy of a diatomic molecule – simple harmonic oscillator – Anharmonic oscillator – diatomic vibrating rotator	5
1.2	Vibrations of polyatomic molecules – fundamental vibrations and their symmetry – influence of rotations on the spectra of polyatomic molecules – linear molecules	6
1.3	symmetric top molecules – skeletal vibrations-group frequencies-techniques and instrumentation – double and single beam operation.	6
2.1	Pure rotation Raman spectra – linear molecules – symmetric top molecules – vibrational Raman spectra	5
2.2	Raman activity of vibrations – rules of mutual exclusion overtone and combination – vibrational Raman spectra – rotational fine structure – nature of polarized light	6
2.3	vibration of spherical top molecules – techniques and instrumentation- the Fourier transform spectroscopy.	5
3.1	Electronic spectra of diatomic molecules- the Born-Oppenheimer Approximation- vibrational Coarse Structure: Progressions	6
3.2	Intensity of Vibrational-Electronic Spectra: the Franck-Condon Principle Rotational fine structure of electronic-vibration transitions, electronic spectra of polyatomic molecules	6
3.3	change of shape of excitation chemical analysis by electronic spectroscopy-the Re-emission of energy by an excited molecule, techniques and instrumentation.	6
4.1	The nature of spinning particles – Interaction between spin and a magnetic field – population of energy levels	6
4.2	Larmor precession and relaxation time – Fourier Transform spectroscopy in NMR – Chemical shift.	6
5.1	Introduction- position of E.S.R absorptions: the g-factor-hyperfine structure of E.S.R absorptions	6
5.2	double resonance in E.S.R- fine structure in E.S.R spectra- technique of E.S.R spectroscopy	6

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined M.Sc. Physics on or after June 2019)
PROGRAMME CODE : PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH19C42	Nanoscience	Core -12	4	1	-	**4**

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

Preamble

- Acquire a qualitative idea on the postulates and concepts of nanophysics.
- Introduce the students to the rapidly developing field of nanoscience and technology with special focus on the methods of synthesis, characterization techniques and applications of nanomaterials with physics emphasis
- Learn the structures, properties, characterization and applications of nanomaterials.

Prerequisite

Knowledge on basic concepts of nanophysics and have an idea on general characterization techniques of nano materials.

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Comprehend the postulates and concepts of nanophysics with clarity	K1
CO2	Grasp the principles, fabrication and design of Carbon Nano-Tubes and their application	K1, K2
CO3	Examine the properties of materials using various characterization tools	K2, K5
CO4	Apprehend the theoretical and experimental aspects of quantum wells, wires and dots	K2, K3
CO5	Realize the techniques of nanomachines and nanodevices, expected to provide the necessary understanding in nanotechnology and the students must be able to perform their project works related to the synthesis and characterization of nanomaterials by direct experience	K2, K4

K1: Knowledge K2: Understand K3: Apply K4:Analyse K5: Evaluate

Mapping of COs with POs

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

Blooms taxonomy

Blooms Taxonomy			
Category	Continuous Assessment		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	20%	20%	20%
Understand -K2	20%	20%	20%
Apply-K3	20%	20%	20%
Analyze-K4	20%	20%	20%
Evaluate-K5	20%	20%	20%
Total Marks	**60**	**60**	**150**

Title of the paper

NANOSCIENCE

Unit I: INTRODUCTION TO PHYSICS OF THE SOLID STATE AND PROPERTIES OF INDIVIDUAL NANO PARTICLES

Size dependence of Properties - Crystal structure – Face-centered cubic nanoparticles - Tetrahedrally bonded semiconductor crystals - Lattice vibrations. Metal Nanoclusters: Magic Numbers-Theoretical Modeling Of Nanoparticles-Geometric Structure-Electronic Structure-Reactivity Fluctuations-Magnetic Clusters-Bulk To Nanotransition, Semiconducting Nanoparticles: Optical Properties-Photofragmentation- Coulombic Explosion

Unit II: CARBON NANOSTRUCTURES

Introduction – Carbon Molecules – Nature of the Carbon bond – New Carbon Structures – Small Carbon Clusters – Discovery of C60 Structure of C60 and its Crystal – Alkali doped C60 – Superconductivity in C60 Larger and Smaller Fullerenes – Other Buckyballs – Carbon nanotubes – Fabrication – Structure – Electric Properties – Vibrational Properties – Mechanical Properties.

Unit III: NANOSTRUCTURED FERROMAGNETISM

Basics of Ferromagnetism – Effect of Bulk Nanostructuring of Magnetic Properties – Dynamics of Nanomagnets – Nanopore containment of Magnetic particles – Nanocarbon Ferromagnets – Giant and Colossal Magnetoresistance – Ferrofluids.

Unit IV:APPLICATION OF CARBON NANOTUBES & QUANTUM WELLS, WIRES, AND DOTS

Field Emission and Shielding – Computers – Fuels – Chemical Sensors – Catalysis – Mechanical Reinforcement. Quantum Wells, Wires and Dots: Preparation of Quantum nanostructures – Size and Dimensionality Effects – Excitons – Single Electron Tunneling – Applications – Infrared Detectors – Quantum Dot Lasers – Superconductivity.

Unit V: NANOMACHINES AND NANODEVICES

Micro electro mechanical systems (MEM) – Nano electromechanical Systems (NEMS): Fabrication – Nanodevices and Nanomachines – Molecular and Supra molecular Switches.

Text Books:

1. Charles P. Poole Jr & Frank J. Owens, 2011.Introduction to Nanotechnology II reprint, Wiley India.

References:

1. Richard Booker & Earl Baysen, 2005.Nano Technology, wiley.

Web Resources:

1. nptel.ac.in/syllabus/syllabus_pdf/115101007.pdf.
2. https://www.electrochem.org/dl/interface/sum/sum06/sum06_p27.pdf.
3. www.wtec.org/loyola/nano/06_03.htm.

4. https://nptel.ac.in/courses/115106076/Module%207/Module%207.pdf.
5. http://www.acclab.helsinki.fi/~knordlun/nanotiede/nanosc9nc.pdf

Course Designers:

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

Lecture Schedule

	Topic	No.of Lecture hrs.
1.1	Size dependence of Properties - Crystal structure – Face-centered cubic nanoparticles - Tetrahedrally bonded semiconductor crystals - Lattice vibrations	5
1.2	Metal Nanoclusters: Magic Numbers-Theoretical Modeling Of Nanoparticles-Geometric Structure-Electronic Structure	5
1.3	Reactivity Fluctuations-Magnetic Clusters-Bulk To Nanotransition, Semiconducting Nanoparticles: Optical Properties- Photofragmentation-Coulombic Explosion	5
2.1	Introduction – Carbon Molecules – Nature of the Carbon bond – New Carbon Structures – Small Carbon Clusters	5
2.2	Discovery of C60 Structure of C60 and its Crystal – Alkali doped C60 – Superconductivity in C60 Larger and Smaller Fullerenes	5
2.3	Other Buckyballs – Carbon nanotubes – Fabrication – Structure – Electric Properties – Vibrational Properties – Mechanical Properties	5
3.1	Basics of Ferromagnetism – Effect of Bulk Nanostructuring of Magnetic Properties – Dynamics of Nanomagnets	5
3.2	Nanopore containment of Magnetic particles – Nanocarbon Ferromagnets	5
3.3	Giant and Colossal Magnetoresistance – Ferrofluids	5
4.1	Field Emission and Shielding – Computers – Fuels – Chemical Sensors – Catalysis – Mechanical Reinforcement	5
4.2	Quantum Wells, Wires and Dots: Preparation of Quantum nanostructures – Size and Dimensionality Effects	5
4.3	Excitons – Single Electron Tunneling – Applications – Infrared Detectors – Quantum Dot Lasers – Superconductivity	5
5.1	Micro electro mechanical systems (MEM)	5
5.2	Nano electromechanical Systems (NEMS): Fabrication	5
5.3	Nanodevices and Nanomachines – Molecular and Supra molecular Switches	5

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined M.Sc. Physics on or after June 2019)
PROGRAMME CODE : PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH19C43	**OPTICAL COMMUNICATION AND NETWORKING**	**Core - 13**	**4**	**1**		**4**

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

Preamble

- Know about various types of fibers.
- Comprehend the transmission characteristics of optical fibers.
- Appreciate the sources and detectors; function of networks etc.,
- Learn various types of losses occuring in optical fibres.

Prerequisite

Basic knowledge on light propagation and fibres.

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Understand the different types of fibres, ray propagation in step index and graded index fibres.	K1, K2
CO2	Explore the various types of losses and dispersion effects in fibres.	K1, K3
CO3	Discuss the working principle of fiber optical sources and detectors applied in the optical communication systems.	K4
CO4	Analyze the operation of optical fibre receivers and optical amplifiers.	K4
CO5	Acquire the knowledge on the concepts of optical network and its application in SONET/SDH/WDM networks	K1 , K5

K1: Knowledge K2: Understand K3: Apply K4:Analyse K5: Evaluate

Mapping of COs with POs

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

Blooms taxonomy

Blooms Taxonomy			
Category	Continuous Assessment		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	20%	20%	20%
Understand -K2	20%	20%	20%
Apply-K3	20%	20%	20%
Analyze-K4	20%	20%	20%
Evaluate-K5	20%	20%	20%
Total Marks	**60**	**60**	**150**

Title of the paper

OPTICAL COMMUNICATION AND NETWORKING

Unit I: OPTICAL FIBER MODES

Fiber types-rays and modes-Step index fiber structure-Ray optics representation –Mode theory for circular waveguides-Key modal concepts-cutoff wavelength and v number-wave equation for step index fiber-modes in step index fibers-single mode fibers-propagation modes in single mode fiber-graded index fiber-core index-graded index numerical aperture-cutoff condition in graded index fibers

Unit II: ATTEUNATION AND DISPERSION

Attenuation– Attenuation units- absorption- scattering losses-Bending losses- core and cladding losses-signal dispersion in fibers-overview of dispersion origins –factors contributing to dispersion-Material Dispersion –Waveguide dispersion – dispersion in single mode fibers.

Unit III: SOURCES AND DETECTORS

Optical sources: Light Emitting Diodes - LED structures – light source materials - quantum efficiency and LED power - laser diodes – laser diode modes and threshold conditions – external quantum efficiency - Optical Detectors: PIN Photo detectors - Avalanche photo diodes - Photo detector noise – Noise sources , Signal to Noise ratio

Unit IV: FIBER OPTIC RECEIVER, MEASUREMENTS AND AMPLIFIERS

Fundamental receiver operation – digital signal operation – error sources – front end amplifier – digital reciver performance – probability of error – receiver sensitivity – quantum limit – eye diagram – eye pattern features – BER and Q-factor measurements – burst mode receivers – analog receivers – Optical amplifiers – basic applications and types of optical amplifiers – general applications – amplifier types – Erbium doped fiber amplifiers – amplification mechanism - EDFA architecture – amplifier noise – optical SNR.

Unit V: OPTICAL NETWORKS

Optical Networks - network concepts – network terminology – network categories – network layers – optic layers - SONET / SDH Transmission formats and speeds – Optical interfaces – SONET / SDH – RINGS - SONET / SDH networks - Optical switching – optical cross connect – wavelength conversion – wavelength routing – optical packet switching – optical burst switching - WDM Network examples – wideband Long-haul WDM Networks – Narrow band metro WDM Networks

TEXT BOOK:

1. Gerd Keiser. 2013.Optical Fiber Communications, Fifth Edition**.** Mc Graw Hill ISBN-13: 978-1-25-900687-6; ISBN-10: 1-25-900687-5

REFERENCE BOOKS:

1. John M. Senior, 2007.Optical Fiber Communication, Second Edition , Pearson Education.
2. Gower, J. 2001. Optical Communication System, Prentice Hall of India,
3. Rajiv Ramaswami, 2004. Optical Networks , Second Edition, Elsevier.
4. Govind P. Agrawal, 2004.Fiber-optic communication systems, third edition, John Wiley& sons.

5. Khare, R.P. 2007. Fiber Optics and Optoelectronics, Oxford University Press.

Web Resources:

1. https://en.wikipedia.org/wiki/Optical_fiber
2. https://en.wikipedia.org/wiki/Dispersion
3. https://en.wikipedia.org/wiki/Optical_networking
4. https://en.wikipedia.org/wiki/Avalanche

Course Designers:

1. Dr. R.Vijayalakshmi
2. Mr.M.Venkatachalam

Lecture Schedule

	Topic	No.of Lecture hrs.
1.1	Fiber types-rays and modes-Step index fiber structure-Ray optics representation –Mode theory for circular waveguides-Key modal concepts-cutoff wavelength and v number	5
1.2	wave equation for step index fiber-modes in step index fibers-single mode fibers-propagation modes in single mode fiber	5
1.3	graded index fiber-core index-graded index numerical aperture-cutoff condition in graded index fibers	5
2.1	Attenuation– Attenuation units- absorption- scattering losses-Bending losses	5
2.2	core and cladding losses- signal dispersion in fibers-overview of dispersion origins –factors contributing to dispersion	5
2.3	Material Dispersion –Waveguide dispersion – dispersion in single mode fibers.	5
3.1	Optical sources: Light Emitting Diodes - LED structures – light source materials - quantum efficiency and LED power	5
3.2	laser diodes – laser diode modes and threshold conditions – external quantum efficiency - Optical Detectors: PIN Photo detectors	5
3.3	Avalanche photo diodes - Photo detector noise – Noise sources , Signal to Noise ratio	5
4.1	Fundamental receiver operation – digital signal operation – error sources – front end amplifier – digital reciver performance – probability of error – receiver sensitivity – quantum limit – eye diagram – eye pattern features	5
4.2	BER and Q-factor measurements – burst mode receivers – analog receivers – Optical amplifiers – basic applications and types of optical amplifiers – general applications	5
4.3	amplifier types – Erbium doped fiber amplifiers – amplification mechanism - EDFA architecture – amplifier noise – optical SNR.	5
5.1	Optical Networks - network concepts – network terminology – network categories – network layers – optic layers - SONET / SDH Transmission formats and speeds	5
5.2	Optical interfaces – SONET / SDH – RINGS - SONET / SDH networks - Optical switching – optical cross connect – wavelength conversion – wavelength routing – optical packet switching	5
5.3	optical burst switching - WDM Network examples – wideband Long-haul WDM Networks – Narrow band metro WDM Networks .	5

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined M.Sc. Physics on or after June 2019)
PROGRAMME CODE : PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH19CE41A	**XRAY CRYSTALLOGRAPHY**	**Elective - 3**	**5**	**1**		**5**

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

Preamble

- ❖ Know the theoretical and experimental aspects involved in X-ray diffraction by single crystals.
- ❖ Understand the relationship between symmetry and scattering of X-rays.
- ❖ Understand the applications of crystallography to study the structures of small molecules and complex biological macromolecules such as proteins.

Prerequisite

Basic knowledge on crystal and its symmetry and also understanding of x-ray diffraction techniques.

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Develop knowledge on the basics of crystal systems and their symmetry(point group/space group)	K1, K2
CO2	Understand the concepts of x-ray diffraction and various diffraction techniques like oscillation, powder, weissenberg methods.	K1, K3
CO3	List out the factors which affect the x-ray intensities in a detailed man.	K5
CO4	Analyze the methods involved in crystal structure determination-viz., trial and error method , Patterson method, etc…	K4
CO5	explore about amino acids and protein crystallography .	K1, K5

K1: Knowledge K2: Understand K3: Apply K4:Analyse K5: Evaluate

Mapping of COs with POs

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

Blooms taxonomy

Blooms Taxonomy			
Category	Continuous Assessment		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	20%	20%	20%
Understand -K2	20%	20%	20%
Apply-K3	20%	20%	20%
Analyze-K4	20%	20%	20%
Evaluate-K5	20%	20%	20%
Total Marks	**60**	**60**	**150**

Title of the paper

XRAY CRYSTALLOGRAPHY

Unit I: CRYSTALS & SYMMETRY

Crystal shapes and habit – Unit cell – Crystal systems – Bravais lattice – Symmetry elements – Point group – Space group (P2, P21, P212121, Pbca, P21/c, Pmmm, Pna21, C2) – Standard and Non-standard settings – Enantiomorphs

Unit II; DIFFRACTION OF X-RAYS AND EXPERIMENTAL METHODS

Braggs law – Miller indices – Concepts of real & reciprocal lattice – Ewald & limiting spheres – Scattering by an electron – Scattering by an atom – Scattering by a crystal – Structure factor – Systematic absences – Laue – Rotation/oscillation – Weissenberg techniques – The powder method – Recent techniques of experimental data collection.

Unit III: FACTORS AFFECTING X-RAY INTENSITIES

Lorentz and polarization factors – Absorption of X-rays – Primary extinction – Secondary extinction – Temperature factor – Anomalous scattering – Break down of Friedel's law.

Unit IV: CRYSTAL STRUCTURE DETERMINATION

Trial and error method – Phase problem – Fourier synthesis – The Patterson function – The heavy atom method – Isomorphous replacement – Inequality relationship – Sign relationships – Phase relationships – Absolute configuration – Conformational analysis – Hydrogen bonds – Structural databases.

Unit V: PROTEIN CRYSTALLOGRAPHY

Amino acids – Hydrophobic and hydrophilic amino acids – Peptides – Peptide bond – Ramachandran map – Proteins – Unit cell size – Molecular Weight determination – Structural organization of proteins – □-helix – □-sheet – □-strands – □-barrel – turns and loops – Protein folding – Data collection methods – Resolution of data – Space group frequencies – Structure solution methods – Structure-function relationships – Protein Data Bank.

TEXT BOOKS:

1. Chatterjee S.K. 1999. X-ray Diffraction – Its theory and Applications Prentice-Hall, New Delhi, (For Units I ,II, III & IV)
2. Woolfson, M.M. 1980. An Introduction to X-ray Crystallography Cambridge University Press-Vikas Publishing House, New Delhi, (For Units III IV relevant pages)
3. Narayanan P. 1998. Essentials of Biophysics, New Age International Publishers, New Delhi, (For Unit V).

REFERENCE BOOKS:

1. Stout G.H. , Jensen, L.H. 1989.X-ray Structure Determination – A Practical Guide : & John Wiley & Sons, New York,
2. Glusker J.P. Trueblood K.N., 1985.Crystal Structure Analysis – A Primer , II ed. Oxford University Press, New York,
3. Cullity, B.D. 1956. Elements of X-ray Diffraction, Addison-Wesley

Web Resources:

1. https://en.wikipedia.org/wiki/Patterson_function
2. https://www.psc.edu/science/Hauptman/Hauptman-phase.html
3. https://en.wikipedia.org/wiki/Amino_acid
4. https://en.wikipedia.org/wiki/X-ray_crystallography

Course Designers:

1. Dr.N.Srinivasan
2. Dr.R.V.Krishna Kumar

Lecture Schedule

	Topic	No.of Lecture hrs.
1.1	Crystal shapes and habit – Unit cell – Crystal systems – Bravais lattice – Symmetry elements	5
1.2	Point group – Space group (P2, P21, P212121, Pbca, P21/c, Pmmm, Pna21, C2)	6
1.3	Standard and Non-standard settings – Enantiomorph	5
2.1	Braggs law – Miller indices – Concepts of real & reciprocal lattice – Ewald & limiting spheres – Scattering by an electron	5
2.2	Scattering by an atom – Scattering by a crystal – Structure factor – Systematic absences – Laue – Rotation/oscillation technique	5
2.3	Weissenberg techniques – The powder method – Recent techniques of experimental data collection.	5
3.1	Lorentz and polarization factors – Absorption of X-rays -Primary extinction – Secondary extinction	5
3.2	Temperature factor – Anomalous scattering – Break down of Friedel's law.	5
4.1	Trial and error method – Phase problem – Fourier synthesis – The Patterson function – The heavy atom method	6
4.2	Isomorphous replacement – Inequality relationship – Sign relationships – Phase relationships	6
4.3	Absolute configuration – Conformational analysis – Hydrogen bonds – Structural databases.	5
5.1	Amino acids – Hydrophobic and hydrophilic amino acids – Peptides – Peptide bond – Ramachandran map	5
5.2	Proteins – Unit cell size – Molecular Weight determination – Structural organization of proteins – □-helix – □-sheet – □-strands – □-barrel – turns and loops – Protein folding	6
5.3	Data collection methods – Resolution of data – Space group frequencies – Structure solution methods – Structure-function relationships – Protein Data Bank.	6

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined M.Sc. Physics on or after June 2019)
PROGRAMME CODE : PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH19CE41B	**ASTROPHYSICS**	**Elective - 3**	**5**	**1**		**5**

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

Preamble

- Understand the methods of collecting stellar data and appreciate how they are used in classifying the stars.
- Know the life of a star from its birth till its death.
- Elaborate the Astronomical Instruments.

Prerequisite

The basic idea of stars, planets, stellar distances, dimensions, chemical compositions, and evolution of stars. Knowledge on Milky way and other galaxies are highly appreciable.

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Acquire knowledge on the fundamentals of stars	K1, K2
CO2	Understand the concepts of laws of radiation and Important relations between stellar parameters	K1, K3
CO3	Recognize the concepts of internal structure of stars	K5
CO4	Familiar with stellar evolution	K4
CO5	Providing phenomenological theories on astronomical instruments	K1, K5

K1: Knowledge K2: Understand K3: Apply K4:Analyse K5: Evaluate

Mapping of COs with POs

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

Blooms taxonomy

Blooms Taxonomy			
Category	Continuous Assessment		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	20%	20%	20%
Understand -K2	20%	20%	20%
Apply-K3	20%	20%	20%
Analyze-K4	20%	20%	20%
Evaluate-K5	20%	20%	20%
Total Marks	**60**	**60**	**150**

Title of the paper

ASTROPHYSICS

Unit I: FUNDAMENTALS Identification of stars – Spherical coordinates – The Altazimuth system – The local equatorial system – The Universal equatorial system – Conversion of coordinates – Magnitude scale – Measurement of apparent luminosity – Various magnitude systems – Corrections for observed magnitudes – Meausrement of terrestrial distances – Measurement of distances within the solar system – Trigonometric parallaxes of stars – Gemoetrical methods – The method of luminosity distance.

Unit II : STARS Laws for radiation in thermodynamic equilibrium – Application of radiation law to stellar photospheres – Defining temperatures of stars by matter waves – Spectral classification of stars – Explanation of MK spectra – Peculiar stellar spectra – Kepler's third law – Binary stars – Discription of a binary system – Visual binaries – Spectroscopic binaries – Eclipsing binaries – Stellar radii – Important relations between stellar parameters.

Unit III :INTERNAL STRUCTURE OF STARS Equation of stellar structure – Polytropic models – Temperature distribution in polytropes – Stellar energy sources – Stellar opacity – Preliminary models of main sequence stars – Models of real stars – Structure of white dwarfs.

Unit IV: STELLAR EVOLUTION

The virial theorem – Evolution near the main sequence – Star formation – Pre-main sequence contraction Post-main sequence evolution – Nucleosynthesis – Superdense remnants – Evolution of close binary systems.

Unit V: ASTRONOMICAL INSTRUMENTS AND SPACE ASTRONOMY Astronomical Instruments: Optical telescopes – Optical photometric instruments and techniques – Optical spectroscopy – Radio telescopes – Infrared Astronomy – Space Astronomies : Infrared Astronomy – Ultraviolet Astronomy – X-ray Astronomy – Gamma ray Astronomy – The Hubble space telescope.

TEXT BOOK:

1. Abhyankar, K.D. 2007. Astrophysics Stars and Galaxies, , University Press, , ISBN:8173713812.

REFERENCE BOOK:

1. Barbieri, C. 2007. Fundamentals of Astronomy , Taylor & Francis, , ISBN: 0750308869.

Web Resources:

1. *https://www.tecepe.com.br/nav/inav_stars.htm*
2. www.astronomy.ohio-state.edu/~depoy/courses/AST172...NOTES/.../structure3.html
3. https://cosmic-watch.com/history-of-astronomical-instruments/

Course Designers:

1. Dr.R.V.Krishna Kumar

Lecture Schedule

	Topic	No.of Lecture hrs.
1.1	Identification of stars – Spherical coordinates – The Altazimuth system – The local equatorial system – The Universal equatorial system – Conversion of coordinates – Magnitude scale –	5
1.2	Measurement of apparent luminosity – Various magnitude systems – Corrections for observed magnitudes – Meausrement of terrestrial distances	6
1.3	Measurement of distances within the solar system – Trigonometric parallaxes of stars – Gemoetrical methods – The method of luminosity distance.	5
2.1	Laws for radiation in thermodynamic equilibrium – Application of radiation law to stellar photospheres	5
2.2	Defining temperatures of stars by matter waves – Spectral classification of stars – Explanation of MK spectra – Peculiar stellar spectra – Kepler's third law – Binary stars	5
2.3	Discription of a binary system – Visual binaries – Spectroscopic binaries – Eclipsing binaries – Stellar radii – Important relations between stellar parameters	5
3.1	Equation of stellar structure – Polytropic models – Temperature distribution in polytropes – Stellar energy sources –.	5
3.2	Stellar opacity – Preliminary models of main sequence stars – Models of real stars – Structure of white dwarfs	5
4.1	The virial theorem – Evolution near the main sequence – Star formation –	6
4.2	Pre-main sequence contraction – Post-main sequence evolution – Nucleosynthesis	6
4.3	Superdense remnants – Evolution of close binary systems	5
5.1	Astronomical Instruments: Optical telescopes – Optical photometric instruments and techniques	5
5.2	Optical spectroscopy – Radio telescopes – Infrared Astronomy	6
5.3	Space Astronomies : Infrared Astronomy – Ultraviolet Astronomy – X-ray Astronomy – Gamma ray Astronomy – The Hubble space telescope.	6

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined M.Sc. Physics on or after June 2019)
PROGRAMME CODE: PPH

CourseCode	Course Title	Category	L	T	P	Credit
PPH19CL21	General Experiments	LAB			5	5

Year	Semester	Int. Marks	Ext.Marks	Total
First	First & Second	40	60	100

Course Outcomes

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

1. Identify the link between theory and practical
2. Develop the skill of performing experiments accurately
3. Report observations and analyses in a scientific manner

List of experiments

1. Elastic constants by Newton's rings
2. Thermal expansion by Newton's rings
3. G.M.Counter
4. Quincke's method
5. Gouy' method
6. M-H hysteresis
7. Error analysis and least squares –Programming
8. Least squares for the leakage resistance of a capacitor
9. Faraday optic rotation
10. Ultrasonics- solids
11. Ultrasonics- liquids
12. Dielectric constant and phase transition
13. Spectrum calibration
14. Refractive index using abbes refract meter and hollow prism
15. Hall coefficient
16. Elliptical Fringes
17. Hyperbolic Fringes
18. Four probe method (Band energy gap)
19. Hartmann's interpolation formula (using powder spectrum)
20. Hartmann's interpolation formula (using spectrometer)
21. Comparison of wavelengths using CDS and spectrometer
22. Interpretation of powder photograph
23. Indexing a zero layer Weissenberg photograph
24. Fraunhoffer diffraction using Laser
25. Millikan's Oil drop expt.
26. Optic bench-biprism

Each experiment is planned for 9 hrs and esach of this experiment can be divided into many number depending on the hours of work

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined M.Sc. Physics on or after June 2019)
PROGRAMME CODE: PPH

CourseCode	Course Title	Category	L	T	P	Credit
PPH19CL22	Electronics Experiments	LAB			5	5

Year	Semester	Int. Marks	Ext.Marks	Total
First	First & Second	40	60	100

Course Outcomes

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

1. Identify the link between theory and designing workable circuits
2. Troubleshoot any simple electronic circuits
3. Report observations and analyses in a scientific manner

List of experiments

21. 741 amplifiers
22. 741 oscillators
23. 555 multivibrators
24. Series and shunt regulation with Zener
25. Regulated power supply with 7805 & 7812
26. 7400 and 7402 gates
27. Analog computation
28. Shift register
29. Decade counter
30. Encoder and decoder
31. Multiplexer and demultiplexer
32. Differentiating, Integrating RC filter
33. Two Stage Amplifier with feedback
34. Two Stage Amplifier without feedback
35. Characteristics (UJT and SCR)
36. FET Amplifier
37. Phase shift oscillator
38. Amplitude modulation
39. Dual power supply
40. Oscillator(Hartley and colpitt)

Each experiment is planned for 9 hrs and each of this experiment can be subdivided depending on the hours of work

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined M.Sc. Physics on or after June 2019)
PROGRAMME CODE: PPH

CourseCode	Course Title	Category	L	T	P	Credit
PPH19CL41	Advanced Experiments	LAB			5	5

Year	Semester	Int. Marks	Ext.Marks	Total
Second	Third & Fourth	40	60	100

Course Outcomes

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

1. Identify the link between theory and designing workable circuits
2. Troubleshoot any simple electronic circuits
3. Appreciate the applications of OP-AMPs, Microprocessor
4. Report observations and analyses in a scientific manner

List of experiments

1. Filters (I order, II order Low and high pass filters, Band pass filters)
2. Study of JK Flip-Flop.
3. Synchronous counter to count any desired sequence.
4. Shift Register (SISO, PIPO)
5. Half Adder, Full Adder, Half Subtractor, Full Subtractor.
6. Karnaugh map simplification
7. Differentiator, Integrator, Comparator, Triangular wave generator.
8. BCD to seven segment display.
9. Simultaneous equation
10. Schmidt Trigger (using 555)
11. UJT relaxation oscillator.
12. Fibre optic communication

MICROPROCESSOR

1. Microprocessor problems for 8 bit addition
2. Microprocessor problems for 8 bit subtraction(binary)
3. Microprocessor problems for 8 bit subtraction(decimal)
4. Microprocessor problems for 8 bit multiplication(binary)
5. Finding a largest number in an array of data
6. Finding a smallest number in an array of data
7. Sorting an array of data in ascending order
8. Sorting an array of data in descending order
9. Finding 1's complement of data
10. Finding 2's complement of data
11. Microprocessor with interfacing

C and C ++ programming and MS EXCEL- Relevant programmes

Each experiment is planned for 9 hrs and each of this experiment can be divided into many number depending on the hours of work

Thiagarajar College (Autonomous) :: Madurai – 625 009
Department of Physics
(For those joined M.Sc. Physics on or after June 2019)
PROGRAMME CODE: PPH

Course Code	Course Title	Category	L	T	P	Credit
PPH19PJ41	Project	PJ			7	7

Year	Semester	Int. Marks	Ext.Marks	Total
Second	Third & Fourth	40	60	100

Individual projects done by the students under the guidance of faculty members

M.Sc. Physics

Assessment values of course learning outcomes and their mapping with program specific outcomes (PSOs)

Major papers

#	Title of the courses	PSO1	PSO2	PSO3	PSO4	PSO5
PPH19C11	Classical Mechanics	5	5	5	7	7
PPH19C12	Statistical Mechanics	5	2	7	7	6
PPH19C13	Advanced Electronics	7	3	2	3	2
PPH19CE1A	Mathematical Physics – I	12	13	15	11	1
PPH19CE1B	Computer simulations	6	3	2	3	2
PPH19C21	Solid state physics –I	7	5	5	4	1
PPH19C22	Electromagnetic theory	8	8	4	3	4
PPH19C23	Quantum mechanics-I	8	3	3	3	5
PPH19CE21A	Mathematical physics II	4	2	5	4	1
PPH19CE21B	Molecular biophysics	4	2	5	4	1
PPH19C31	Solid state physics –II	6	2	4	4	2
PPH19C32	Quantum mechanics II	5	3	5	2	1
PPH19C33	Nuclear physics	6	4	5	1	1
PPH19C34	Microprocessor and Micro Controllers	7	2	5	4	2
PPH19C41	Spectroscopy	6	3	2	3	2
PPH19C42	Nanoscience	7	7	1	2	3
PPH19C43	Optical communication and networking	5	4	4	2	2
PPH19CE41A	X-ray crystallography	8	4	3	1	3
PPH19CE41B	Astrophysics	8	4	3	3	3

M.Phil. Physics

Programme Code : MPH

Programme outcome-PO (Aligned with Graduate Attributes)- Master of Philosophy (M.Phil.,)

Knowledge and critical thinking

Acquire, analyse, evaluate and interpret data using appropriate techniques. Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

Problem solving

Critically evaluate information and ideas from multiple perspectives. Employ conceptual, analytical, quantitative and technical skills in solving the problems and are adept with a range of technologies

Complementary Skills

Recognize the need for information, effectively search for, retrieve, evaluate and apply that information gathered in support of scientific investigation or scholarly debate.

Communication efficiency

Communicate and disseminate clearly and convincingly the research findings effectively in the academic community and to stakeholders of their discipline in written and or oral form. Elaborate on the ideas, findings and contributions in their field of interest to expert and non-expert audiences.

Environment, Ethical and Social relevance

Apply ethical principles for societal development on environment context. Demonstrate the knowledge of and need for sustainable development.

Life-Long Learning

Recognize the need, and have the ability, to engage in continuous reflective learning in the context of technological advancement.

Team work

Work effectively in teams, both collaboratively and independently to meet a shared goal with people whose disciplinary and cultural backgrounds differ from their own. Engage in intellectual exchange of ideas with researchers of other disciplines to address important research issues

Program specific Outcomes:

At the end of the programme, the students will be able to	
PSO1	Acquire a firm grasp of the principles and methods necessary to undertake research in physics.
PSO2	An advanced level exposure to fundamental areas indispensable for experimental research in condensed matter physics and a few other related fields.
PSO3	Expertise in preparation and handling of samples, recording and analysis of data in diverse state-of-the art research facilities/softwares/database pertinent to the dissertation work
PSO4	A comprehensive understanding of solutions to some advanced research problems to help identify and formulate new problems.
PSO5	Exposure to contemporary issues in research and importance of adhering to ethical principles in writing a research report.

THIAGARAJAR COLLEGE, MADURAI- 9
(Re-Accredited with 'A' Grade by NAAC)
DEPARTMENT OF PHYSICS
M.Phil., Physics (w.e.f. 2019 batch onwards)
COURSE STRUCTURE
PROGRAMME CODE: MPH
Semester – I

Course	Code No	Subject	Contact Hrs / Week	Credits	Total No of Hrs Allotted/ Semester	Max Marks CA	Max Marks SE	Total
CORE	MPH19C11	Elements of Research Methods in Physics	6	6	90	100	100	200
CORE	MPH19C12	Advanced Physics	6	6	90	100	100	200
*Core Elective	MPH19CE11 A/B/C/D	Elective	6	6	Nil*	100	100	200

Course	Code No	Subject	Contact Hrs / Week	Credits	Total No of Hrs Allotted/ Semester	Max Marks CA	Max Marks SE	Total
Core	MPH19PJ21	Dissertation Viva-Voce	-	6	-	100	100	200

List of Elective Papers

- Spectroscopy- MPH19CE1A
- Thin Films- MPH19CE1B
- X-Ray Crystallography- MPH19CE1C
- Ultrasonics- MPH19CE1D

Thiagarajar College (Autonomous):: Madurai – 625 009
Department of Physics
(For those joined M.Phil. Physics on or after June 2019)
PROGRAMME CODE: MPH

Course Code	Course Title	Category	L	T	P	Credit
MPH19C11	**ELEMENTS OF RESEARCH METHODS IN PHYSICS**	**CORE**	**6**	**-**	**-**	**6**

Year	Semester	Int. Marks	Ext. Marks	Total
First	First	100	100	200

Preamble

1. Understand the fundamental principles and concepts involved in the methods of research in Physics
2. Appreciate the analytical methods involved in the research areas of Physics.

Prerequisite

Firm knowledge on crystal structure, spectroscopic method and non-destructive method

Course Outcomes

On the completion of the course the student will acquire profound knowledge on

#	Course Outcome	Knowledge Level
CO1	The elementary ideas of crystal structure determination	K1 & K2
CO2	The concept of symmetry and the symmetry elements to determine the point group of various molecules.	K2,K4&K5
CO3	Apply the Instrumentation and sample handling techniques of UV-vis, IR and Raman spectroscopic methods	K1,K3 & K6
CO4	the basic concepts of molecular modelling and the implementation of molecular computational methods .	K1 ,K5 &K6
CO5	the principles of non-destructive testing.	K1, K3

K1: Knowledge K2: Understand K3: Apply K4: Analyse K5: Evaluate K6: Create

Mapping of COs with POs

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

Blooms taxonomy

	CA		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	20	20	-
Understand -K2	20	20	40
Apply-K3	20	20	40
Analyze-K4	20	20	40
Evaluate-K5	20	20	40
Create-K6	20	20	40
Total	**120**	**120**	**200**

Title of the paper

Unit I: ELEMENTS OF CRYSTALS

Symmetry of crystals : Modes of repetition – Symmetry elements – Classification of crystals – Notation of crystal faces – Projection of crystals : Perspective projections – Gnomonic projection – Stereographic projection

Unit II:SYMMETRY

Symmetry in nature – Symmetry in a molecule – Symmetry elements – Various types of symmetry operations – Point groups – Properties of point groups – Determination of the point group of a molecule – Representations of Groups – The character – Character table for point groups.

Unit III: ANALYTICAL METHODS UV-Vis spectroscopy:

Fundamental laws of photometry, deviations from Beer's law - **IR spectroscopy:** Introduction, correlation of IR spectra with molecular structure, instrumentation, sample handling - **Raman spectroscopy:** theory, resonance Raman spectroscopy, instrumentation, sampling techniques - **NMR spectroscopy:** Basic principles, pulsed Fourier transform NMR spectrometer – **Thermal analysis:** DSC and DTA - instrumentation, thermogravimetry, methodology of TG, DSC and DTA.

Unit IV: QUANTUM CHEMICAL COMPUTATIONS Fundamental principles: energy, electrostatics, atomic units, thermodynamics, quantum mechanics, statistical mechanics, Hartree - Fock approximation, semiempirical methods, density functional theory: basic theory, linear scaling techniques, practical considerations.

Unit V: NON-DESTRUCTIVE TESTING

Liquid penetrant testing- principle – testing methods- – Radiography – principles- Inspection techniques- Ultrasonic testing principle- pulse-echo and through transmission technique- Ultrasonic flaw detector- Acoustic emission testing – principle- instrumentation.

TEXT BOOKS:

1. Azaroff, L. V. 1968. Elements of X-ray Crystallography, McGraw Hill, **[Unit I]**
2. Chandra, A. K. 1988. Introduction to Quantum Chemistry, 3rd ed., Tata McGraw Hill, **[Unit II]**
3. Willard, H. H. Merritt, L. L. Dean, J. A. Settle, F. A. 1986.Instrumental methods of analysis 7th ed., CBS Publishers & Distributors **[Unit III]**
4. Young, D. C. 2001. Computational chemistry: A practical guide for applying techniques to real-world problems, John Wiley & Sons, Inc **[Unit IV]**
5. Baldevraj, Jayakumar, , T. Thavasimuthu, M. 2007., Practical Non-Destructive Testing,3rd ed., Narosa publishing house **[Unit V]**

Course Designers:

1. Dr. R.Vijayalakshmi
2. Dr.N.Srinivasan
3. Dr.R.V.Krishna Kumar
4. Dr. G.Arivazhagan

5. Dr.R.Srinivasan
6. Dr.S.Rajakarthihan
7. Dr.J.Suvetha Rani

Lecture Schedule

	Topic	No. of Lecture hrs.
1.1	Symmetry of crystals : Modes of repetition – Symmetry elements	5
1.2	Classification of crystals – Notation of crystal faces	7
1.3	Projection of crystals : Perspective projections – Gnomonic projection – Stereographic projection	6
2.1	Symmetry in nature – Symmetry in a molecule – Symmetry elements – Various types of symmetry operations	7
2.2	Point groups – Properties of point groups – Determination of the point group of a molecule	5
2.3	Representations of Groups – The character – Character table for point groups.	6
3.1	**UV-Vis spectroscopy:** Fundamental laws of photometry, deviations from Beer's law - **IR spectroscopy:** Introduction, correlation of IR spectra with molecular structure, instrumentation, sample handling	5
3.2	**Raman spectroscopy:** theory, resonance Raman spectroscopy, instrumentation, sampling techniques - **NMR spectroscopy:** Basic principles, pulsed Fourier transform NMR spectrometer	6
3.3	**Thermal analysis:** DSC and DTA - instrumentation, thermogravimetry, methodology of TG, DSC and DTA.	7
4.1	Fundamental principles: energy, electrostatics, atomic units,	6
4.2	thermodynamics, quantum mechanics, statistical mechanics, Hartree - Fock approximation, semiempirical methods,	7
4.3	density functional theory: basic theory, linear scaling techniques, practical considerations.	5
5.1	Liquid penetrant testing- principle – testing methods- – Radiography – principles- Inspection techniques-	6
5.2	Ultrasonic testing principle- pulse-echo and through transmission technique	5
5.3	Ultrasonic flaw detector- Acoustic emission testing – principle-instrumentation.	7

Thiagarajar College (Autonomous):: Madurai – 625 009
Department of Physics
(For those joined M.Phil. Physics on or after June 2019)
PROGRAMME CODE: MPH

Course Code	Course Title	Category	L	T	P	Credit
MPH19C12	**ADVANCED PHYSICS**	**CORE**	**6**			**6**

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	100	100	200

Preamble

1. Gain theoretical knowledge in some of the major areas of research in materials science
2. Understand the advanced techniques involved in the research field

Prerequisite

Basics knowledge of the properties of nano materials and solar energy

Course Outcomes

On the completion of the course the student will acquire profound knowledge on

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	the elementary ideas of Nano structures	K1 & K2
CO2	characterization techniques of Nano materials	K2,K4&K5
CO3	preparation and characterization of thin films	K1,K3 & K6
CO4	the structure elucidation from NMR spectra	K1&,K5
CO5	the principles of solar energy storing devices.	K1& K2

K1: Knowledge K2: Understand K3: Apply K4: Analyse K5: Evaluate K6: Create

Mapping of COs with POs

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

Blooms taxonomy

	CA		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	20	20	-
Understand -K2	20	20	40
Apply-K3	20	20	40
Analyze-K4	20	20	40
Evaluate-K5	20	20	40
Create-K6	20	20	40
Total	**120**	**120**	**200**

Title of the paper

ADVANCED PHYSICS

Unit I:BASIC QUANTUM CONCEPTS OF NANO STRUCTURES:
Heterostructures – General properties and growth of hetero structures – Band engineering Doped heterostructures – Wires and dots – Optical confinement

Unit II : CHARACTERIZATION, PROPERTIES AND APPLICATIONS OF NANO MATERIALS. Introduction, structure characterization, chemical characterization, physical properties of nano materials, electrical conductivity, ferroelectrics and dielectrics, super paramagnetism.

Unit III: THIN FILMS
Introduction, fundamentals of film growth, vacuum science, physical vapor deposition, chemical vapor deposition, atomic layer deposition, Langmuir-Blodgett films, Electrochemical deposition, Sol-gel films.

Unit IV:ADVANCED NMR TECHNIQUES
Pulse sequences, pulse widths, spins and magnetization vectors, pulsed field gradients, the DEPT experiment, determining the number of attached hydrogens, Introduction to two dimensional spectroscopic methods: the COSY and the HETCOR techniques, an overview of the COSY and HETCOR experiments, inverse detection methods, the NOESY experiment.

Unit V: SOLAR CONCENTRATING COLLECTORS AND ENERGY STORAGE. Focusing Type – parabolic Type – non-focusing type – compound parabolic concentration – Performance analysis of a cylindrical parabolic concentrating collector – Selective absorber coating – Solar thermal storage – Solar pond- Construction and operation of Solar pond.

TEXT BOOKS:
1. Hohn H. Davies, 1998. The Physics of low dimensional semiconductors, Cambridge University Press (Unit I)
2. Gao, H. 2004. Nano structures & nanomaterials, Imperial college press (Unit II & III)
3. Pavia, D. L. Lampman, G. M. Kiez G. S., Vyvyan J. R., Introduction to spectroscopy, IV ed., Brooks/Cole Cengage learning, USA. (Unit IV)
4. Rai, G. D. 1997. Non-conventional Energy Sources, Khanna Publishers (Unit V)

Course Designers:
1. Dr. R.Vijayalakshmi
2. Dr.N.Srinivasan
3. Dr.R.V.Krishna Kumar
4. Dr. G.Arivazhagan 5. Dr.R.Srinivasan
6. Dr.S.Rajakarthihan 7. Dr.J.Suvetha Rani

Lecture Schedule

	Topic	No. of Lecture hrs.
1.1	Heterostructures – General properties and growth of hetero structures	6
1.2	Band engineering Doped heterostructures – Wires and dots	7
1.3	Optical confinement	5
2.1	Introduction, structure characterization, chemical characterization,	7
2.2	physical properties of nano materials	5
2.3	electrical conductivity, ferroelectrics and dielectrics, super paramagnetism.	6
3.1	Introduction, fundamentals of film growth, vacuum science, physical vapor deposition,	5
3.2	chemical vapor deposition, atomic layer deposition, Langmuir-Blodgett films,	6
3.3	Electrochemical deposition, Sol-gel films.	7
4.1	Pulse sequences, pulse widths, spins and magnetization vectors, pulsed field gradients, the DEPT experiment, determining the number of attached hydrogens,	6
4.2	Introduction to two dimensional spectroscopic methods: the COSY and the HETCOR techniques, an overview of the COSY and HETCOR experiments,	7
4.3	inverse detection methods, the NOESY experiment.	5
5.1	Focusing Type – parabolic Type – non-focusing type –	6
5.2	compound parabolic concentration – Performance analysis of a cylindrical parabolic concentrating collector	5
5.3	Selective absorber coating – Solar thermal storage – Solar pond- Construction and operation of Solar pond.	7

Thiagarajar College (Autonomous):: Madurai – 625 009
Department of Physics
(For those joined M.Phil. Physics on or after June 2019)
PROGRAMME CODE: MPH

Course Code	Course Title	Category	L	T	P	Credit
MPH19CE11A	**SPECTROSCOPY**	**Core elective**				**6**

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	100	100	200

Preamble

1. Understand the principles involved in various spectroscopy
2. Elucidate structural information of complex molecules from their spectra.

Prerequisite

Thorough understanding of various principles involved in molecular spectra viz., rotation, vibration, electronic spectra and basic principles in Raman, NMR and ESR.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Understand the important aspects of infrared (IR) spectroscopy and its application to derive molecular information.	K1,K2&K4
CO2	Knowledge in the fundamental and experimental principles of nuclear magnetic resonance (NMR) and its application in elucidating information about molecular structure.	K1&K3
CO3	Exposure to the aspects of ultraviolet and visible (UV-Vis) spectroscopy and its versatility in research and industrial applications.	K3,K4&K5
CO4	Sufficient knowledge in the principles and application of mass spectrometry in deriving a variety of information about molecules of a sample.	K1&K6
CO5	Understand the foundation of photoacoustics and its usefulness in a wide range of fields.	K2&K5

K1: Knowledge K2: Understand K3: Apply K4: Analyse K5: Evaluate K6: Create

Mapping of COs with POs

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

Blooms taxonomy

	CA		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	20	20	-
Understand -K2	20	20	40
Apply-K3	20	20	40
Analyze-K4	20	20	40
Evaluate-K5	20	20	40
Create-K6	20	20	40
Total	**120**	**120**	**200**

Title of the paper

SPECTROSCOPY

Unit I: INFRARED SPECTROSCOPY Units of frequency, wavelength and wavenumber, molecular vibration: calculation of vibrational frequencies, modes of vibration, quantum restrictions, factors influencing vibrational frequencies, absorbance and transmittance scale, applications of infrared spectroscopy: identity by fingerprinting and identification of functional groups.

Unit II: NMR SPECTROSCOPY Proton NMR: The NMR phenomenon, theory of nuclear magnetic resonance, chemical shift and its measurement, internal standards, units used in NMR spectroscopy, the splitting of NMR signals in proton NMR spectra, theory of spin-spin splitting, magnitude of the coupling - coupling constants.

Unit III: ULTRAVIOLET AND VISIBLE SPECTROSCOPY The chromophore concept, theory of electronic spectroscopy: orbitals involved in electronic transitions, Beer's and Lambert's law, conventions, instrumentation and sampling, solvents and solutions, solvent effects.

Unit IV: MASS SPECTROMETRY Basic principles, instrumentation: sample insertion - inlet systems, ion production in the ionization chamber, separation of ions in the analyzer, the detector - recorder, data handling, isotope abundances, the molecular ion: structure of the molecular ion, recognition of the molecular ion, molecular formula from the molecular ion, metastable ions: the nature of metastable ions, ion tube regions. calculation of metastable ion values.

Unit V: PHOTOACOUSTICS History of Photoacoustics – prehistory and modern history -Theory of PAS of gases – absorption of light – excitation of acoustic wave – energy transfer physics - Rosencwaig - Gersho theory – special cases – experimental verification – photoacoustic transport in a fluid.

TEXT BOOKS:

1. Kemp, W. 1991. Organic spectroscopy ,3rd ed., Macmillan press Ltd., (Units I - IV)
2. Rosencwaig, A. 1980. Photoacoustics and Photoacoustic spectroscopy, John Wiley, (Unit V)

REFERENCE BOOKS:

1. Straughan, B.P. Walker, S. 1996.Spectroscopy [Vol. II], John Wiley & Sons, New York.
2. Aruldhass, G. 2007. Molecular structure and spectroscopy, 2nd ed., Prentice – Hall of India,
3. Banwell, C. N. McCash, E. M. 2000. Fundamentals of spectroscopy, Tata McGraw-Hill

Course Designers:

1. Dr. G.Arivazhagan
2. Dr.R.Srinivasan
3. Dr.J.Suvetha Rani

Thiagarajar College (Autonomous):: Madurai – 625 009
Department of Physics
(For those joined M.Phil. Physics on or after June 2019)
PROGRAMME CODE: MPH

Course Code	Course Title	Category	L	T	P	Credit
MPH19CE11B	**THIN FILMS**	**Core elective**				

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	100	100	200

Preamble

1. Know about the fabrication of thin films.
2. Understand about the instruments used for characterization of thin films.

Prerequisite

Basic knowledge on the properties and preparation of thin films

Course Outcomes

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

#	Course Outcome	Knowledge Level (according to Bloom's Taxonomy)
CO1	Understand the fundamental principles and experimental techniques of fabrication of thin films.	K1&K4
CO2	Exposure to fundamental principles underlying the state-of-of the art research techniques crucial to the characterization of thin films.	K1&K2
CO3	Sufficient knowledge in the principles and methods of epitaxial film growth and characterization.	K1,K3&K4
CO4	Assess and understand the application of mechanical and optical properties of thin films.	K2&K6
CO5	Assess and understand the application of electrical and magnetic properties of thin films.	K2&K5

K1: Knowledge K2: Understand K3: Apply K4: Analyse K5: Evaluate K6: Create

Mapping of COs with POs

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

Blooms taxonomy

	CA		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	20	20	-
Understand -K2	20	20	40
Apply-K3	20	20	40
Analyze-K4	20	20	40
Evaluate-K5	20	20	40
Create-K6	20	20	40
Total	**120**	**120**	**200**

Title of the paper

Unit I: FABRICATION OF THIN FILMS Film thickness uniformity and purity – Evaporation hardware and techniques – Glow discharges and plasmas – Sputtering – Sputtering processes – Hyrbrid and modified PVD processes – Chemical vapour deposition: Reaction types – Thermodynamics of CVD – Gas transport – Growth kinetics – CVD processes and systems.

Unit II: CHARACTERIZATION OF THIN FILMS Film thickness: Optical and mechanical methods for measuring film thickness – Structural characterization : Scanning electron microscopy (SEM) – Transmission electron microscopy (TEM) – X-ray diffraction – Chemical characterization : Electron spectroscopy – X-ray Energy-Dispersive Analysis (EDX) – Auguer electron spectroscopy (AES) – X-ray photoelectron spectroscopy (XPS) – Rutherford backscattering (RBS) – Secondary Ion Mass Spectrometry. **Unit III : EPITAXY** Structural aspects of epitaxial films – Lattice misfit and imperfections in epitaxial films – Epitaxy of compound semiconductors – Methods for depositing epitaxial semiconductor films – Epitaxial film growth and characterization.

Unit IV: MECHANICAL AND OPTICAL PROPERTIES

Elasticity, Plasticity and Mechanical behavior of thin films – Internal stresses and their analysis – Stress in thin films – Relaxation effects in stressed films – Adhesion – Properties of optical film materials – Thin film optics – Multilayer optical film applications.

Unit V: ELECTRICAL AND MAGNETIC PROPERTIES Electrical properties of thin films – Conduction in Metal films – Electrical transport in insulating films – Semiconductor contacts and MOS structures – Superconductivity in thin films – Ferromagnetism – Magnetic film size effects vs. thickness and temperature – Magnetic thin films for memory applications.

TEXT BOOKS:

1. Granquist, G., 1998. A Handbook of inorganic materials, ElsevierPublication, Amsterdam,
2. Willard, Meritt, Dean J.A. Settle, F.A., 1986. Instrumentation methods of analysis VI CBS published, India.Progress in intercalation Research, Kluwar Academic Publishes Dordlechet/London & Boston, Edited by W. Muller-Warmuth & R.Schollhorn.
3. Goswamy, 1996.Thin film fundamentals, New Age International, New Delhi.

Course Designers:

1. Dr. R.Vijayalakshmi

Thiagarajar College (Autonomous):: Madurai – 625 009
Department of Physics
(For those joined M.Phil. Physics on or after June 2019)
PROGRAMME CODE: MPH

Course Code	Course Title	Category	L	T	P	Credit
MPH19CE11C	**X-RAY CRYSTALLOGRAPHY**	**Core**				**6**

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	100	100	200

Preamble

1. Understand the principles involved in the application of X-ray crystallography
2. Determine the structure of crystals

Prerequisite

Basic knowledge on crystal and its symmetry and also understanding of x-ray diffraction techniques.

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Comprehensive understanding of the geometrical principles of the crystalline state of matter.	K1&K2
CO2	Firm grasp of the fundamentals of single crystal X-ray diffraction and its experimental aspects necessary for collection of intensity data.	K2&K3
CO3	Exposure to the important factors that affect X-ray single crystal intensity data and remedial measures.	K1&K4
CO4	Knowledge in employing various methods of determination of crystal structures.	K1&K5
CO5	Expertise in handing softwares pertinent to crystal structure determination and exploring Cambdridge Structural Database to identify structural features and arrive at meaningful conclusions.	K4,K5&K6

K1: Knowledge K2: Understand K3: Apply K4: Analyse K5: Evaluate K6: Create

Mapping of COs with POs

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

Blooms taxonomy

	CA		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	20	20	-
Understand -K2	20	20	40
Apply-K3	20	20	40
Analyze-K4	20	20	40
Evaluate-K5	20	20	40
Create-K6	20	20	40
Total	**120**	**120**	**200**

Title of the paper

Unit I: GEOMETRY OF THE CRYSTALLINE STATE The general features of crystals – The external symmetry of crystals – The seven crystal systems – The thirty-two crystal classes – The unit cell – Miller indices – Space lattices – The reciprocal lattice – Symmetry elements – Space groups – Space group and crystal class.

Unit II:X-RAY DIFFRACTION DATA Conditions for diffraction to occur – Diffractometers – X-ray sources – Image plate systems– Diffraction from a rotating crystal

Unit III :FACTORS AFFECTING X-RAY INTENSITIES Absorption of X-rays – Primary extinction – Secondary extinction – The temperature factor – Anomalous scattering – Tests for lack of a centre of symmetry – The symmetry of X-ray photographs – Systematic absences – Detection of mirror plans and diad axes.

Unit IV: DETERMINATION OF CRYSTAL STRUCTURES Trial and error methods – The Patterson function – The heavy-atom method – sIsomorphous replacement – The application of anomalous scattering – Direct methods: Inequality relationships – Sign relationships – General phase relationships.

Unit V: REFINEMENT AND ANALYSIS OF STRUCTURE Absolute configuration – Conformational analysis – Hydrogen bonds – Cambridge Structural Database – WinGX : An Integrated System of Windows Programs for the Solution, Refinement and Analysis of Single Crystal X-ray Diffraction Data – The Rietveld technique.

TEXT BOOKS:

1. Woolfson, M.M., 1997.An Introduction to X-ray Crystallography (II ed.), Cambridge University Press, ISBN 0-521-42359-7
2. Ladd, M.F.C. & Palmer, R.A., 2003. Structure Determination by X-ray Crystallography , IV Ed., Springer.
3. Pattabhi, V. & Gauttham, N., 2002. Biophysics, Kluwer Academic Publishers
4. Rhodes, G, 2006. Crystallography Made Crystal Clear: A Guide for Users ofMacromolecular Models, III ed., Elsevier
5. Stout, G.H. & Jensen, L.H., 1989. X-ray Structure Determination – A Practical Guide, JohnWiley & Sons
6. Glusker, J.P. & Trueblood, K.N., 1985. Crystal Structure Analysis – A Primer , II ed., Oxford University Press, ISBN 0-19-503543-7.

Course Designers:

1. Dr.N.Srinivasan
2. Dr.R.V.Krishna Kumar

Thiagarajar College (Autonomous):: Madurai – 625 009
Department of Physics
(For those joined M.Phil. Physics on or after June 2019)
PROGRAMME CODE: MPH

Course Code	Course Title	Category	L	T	P	Credit
MPH19CE11D	**ULTRASONICS**	**Core**				**6**

Year	Semester	Int. Marks	Ext.Marks	Total
First	First	100	100	200

Preamble

1. Understand the basic concept of ultrasonics
2. Know the generation and transducers of ultrasonics
3. Acquire the measurement techniques of ultrasound
4. Appreciate the application of ultrasonic in liquids and solid systems

Prerequisite

Basic knowledge on sound waves and the properties of ultrasonic waves

Course Outcomes

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

#	Course Outcome	Knowledge Level
CO1	Understand the different modes of Ultrasonic waves and their characteristic properties	K1&K2
CO2	Acquire the knowledge about the different types of generation of Ultrasonic waves and the types of transducers.	K1&K2
CO3	Learn about various techniques to measure Ultrasound	K2,K4 &K5
CO4	Measure the ultrasonic velocity and other acoustical parameters of liquid mixtures	K3,K5&K6
CO5	Gain exposure on Ultrasonic Non Destructive Testing methods and about flaw detector.	K3&K6

K1: Knowledge K2: Understand K3: Apply K4: Analyse K5: Evaluate K6: Create

Mapping of COs with POs

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

Blooms taxonomy

	CA		End of Semester Marks
	I Internal Marks	II Internal Marks	
Knowledge -K1	20	20	-
Understand -K2	20	20	40
Apply-K3	20	20	40
Analyze-K4	20	20	40
Evaluate-K5	20	20	40
Create-K6	20	20	40
Total	**120**	**120**	**200**

Title of the paper

Unit I: FUNDAMENTALS OF ULTRASONICS Ultrasonic waves – Different modes of ultrasonic waves- Characteristic properties of ultrasonic waves- behaviour of ultrasonic waves - reflection and transmission at normal incidence, mode conversion, critical angle and attenuation.

Unit II: ULTRASONIC GENERATIONS AND TRANSDUCERS Ultrasonic generation- mechanical method- magnetostrictive method- piezoelectric method- transducer materials- types of transducers- normal beam, twin crystal and angle beam transducer.

Unit III: MEASUREMENT TECHNIQUES OF ULTRASOUND Pulse technique- sing around method- pulse superposition method- pulse echo overlap method- cross-correlation method- direct method- attenuation measurement methods.

Unit IV: ULTRASONIC STUDY OF LIQUID MIXTURES Types of molecular interactions- ultrasonic study of molecular interactions- preparation of multi component liquid mixtures- measurement techniques- behaviour of ultrasonic waves in pure liquids, mixtures and gases- theories of ultrasonic velocity in mixtures and solutions- acoustical parameters obtained from velocity and other data.

Unit V: ULTRASONIC NON-DESTRUCTIVE TESTING Classification of ultrasonic testing- pulse echo and through transmission method- different types of technique in pulse echo method- ultrasonic flaw detector- types of scan- A, B and C scan techniques- ultrasonic inspection of welds by angle beam probes- synthetic aperture focussing technique- time of flight diffraction technique.

TEXT BOOK: Baldev Raj, Rajendran V., Palanichamy, P. 2004. Science and technology of ultrasonic, Narosa Publishing House, New Delhi. ISBN 81-7319-202-2.

REFERENCE BOOKS:

1. Subramanian, C.V 2011. Practical Ultrasonics, Narosa Publishing House, New Delhi ISBN 978-81-7319-646-1.
2. Baldev Raj, Jayakumar T Thavasimuthu,. T. 2007. Practical Non-destructive testing-, and Narosa Publishing House, New Delhi, I SBN 978-81-7319-797-0.
3. Blitz J. 1971. Ultrasonic methods and applications, Butter worth Public.& co

Course Designers:

1. Dr.S.Rajakarthihan

M.Phil. Physics

Assessment values of course learning outcomes and their mapping with program specific outcomes (PSOs)

Major papers

#	Title of the courses	PSO1	PSO2	PSO3	PSO4	PSO5
MPH19C1	Elements of Research Methods in Physics	15	12	11	14	9
MPH19C2	Advanced Physics	15	12	14	13	10
MPH19CE1A	Spectroscopy	15	12	12	11	7
MPH19CE1B	Thin Films	15	14	12	11	6
MPH19CE1C	X-Ray Crystallography	15	14	12	14	9
MPH19CE1D	Ultrasonics	15	13	14	8	8
	Dissertation / Viva-Voce					