DEPARTMENT OF PHYSICS

PREAMBLE

UG: Program Profile and list of Courses offered to other Departments and Syllabi of Courses in the I & II Semesters along with Evaluation Components III & IV (with Effect from 2021-2024 Batch onwards) and

PG: Program Profile and list of Courses offered to other Departments and Syllabi of Courses in the I & II Semesters along with Evaluation Components III & IV (with Effect from 2021-2023 Batch onwards)

PROGRAMME PROFILE B.Sc., PHYSICS

PROGRAMME SPECIFIC OUTCOMES (PSO)

Upon completion of the programme, the students will be able to

- Ability to solve and apply the Concepts of Physics in various fields like Material Science, Mechanics, Thermal Physics and Electricity.
- Learning of Laboratory Skills, enabling Measurements in basic Physics and Analysis of Measurements to draw valid Conclusions.
- Developing the Problem Solving Skills and Scientific Reasoning for the Prospective Physicists and Logical Reasoning.
- Analyze the behavior of Materials from Atomic Level to Macroscopic Level.

Semester	Part	Category	Course code	Course Title	Previous Course Code	Contact Hrs/Week	Credit Min/ Max
I	I	Languages / AECC – II Tamil/ Hindi/ French	UTAL107/ UTAL108	Basic Tamil I/ Advanced Tamil I	UTAL105/ UTAL106/ UHIL101/ UFRL101	5	3/4
	II	Communicative English /AECC – I	UENL109/ UENL110	English for Communication (Stream – I)/ English for Communication (Stream – II)	UENL107/ UENL108	5	3/4
	III	Major Core (DSC) – I	UPHM106	Properties of Matter	-	4	4
	III	Major Core (DSC) – II	UPHM107	Mechanics	UPHM103	5	5
	III	Major Core (DSC) – III	UPHR102/ UPHR202	Major Practical I	-	3	2
	III	Allied (GE) – I	UMAA114	Allied Mathematics I	UMAA104	6	5
	III	PE	UPEM101	Professional English I	-	6	4
	IV	Value Education (SEC)			-	2	1
					TOTAL	**36**	**27/29**
II	I	Languages / AECC – II Tamil/ Hindi/ French	UTAL207/ UTAL208	Basic Tamil I/ Advanced Tamil I	UTAL205/ UTAL206 UHIL201/ UFRL201	5	3/4
	II	Communicative English /AECC – I	UENL209/ UENL210	English for Communication (Stream – I)/ English for Communication (Stream – II)	UENL207/ UENL208	5	3/4
	III	Major Core (DSC) – IV	UPHM204	Thermal and Statistical Physics	UPHM203	4	4
	III	Major Core (DSC) – V	UPHM205	Optics	UPHM302/ UPHM406	4	4

Semester	Part	Category	Course Code	Course Title	Previous Course Code	Contact Hrs/Week	Credit Min/ Max
II	III	Major Core (DSC) – VI	UPHR203/ UPHR101	Major Practical II	-	3	2
	III	Allied (GE) - I	UMAA222	Allied Mathematics II	UMAA212	6	5
	III	PE	UPEM201	Professional English I	-	6	4
	IV	NME (Skill Enhancement Course)	-	-	-	3	2
	V	Extension Programme/ Physical Education/NCC	-	-	-	-	1/2
					TOTAL	**36**	**28/31**
III	I	Languages / AECC – II Tamil/ Hindi/ French	UTAL307/ UTAL308	Basic Tamil I/ Advanced Tamil I	UTAL305/ UTAL306/ UHIL301/ UFRL301	5	3/4
	II	Communicative English /AECC – I	UENL309/ UENL310	English for Communication (Stream – I)/ English for Communication (Stream – II)	UENL307/ UENL308	5	3/4
	III	Major Core (DSC) – VII	UPHM303	Electricity and Magnetism	UPHM402	5	4
	III	Major Core (DSC) – VIII	UPHM304	Mathematical Physics	UPHM509	4	3
	III	Major Core (DSC) – IX	UPHR303	Major Practical III	-	3	2
	III	Allied (GE) - III	UCSA306	Computational Physics with Python	-	3	3
	III	Allied (GE) - IV	UCSR310	Computational Physics with Python Lab	-	3	2
	IV	Value Education (SEC)	-	-	-	2	1
					TOTAL	**30**	**21/23**
IV	I	Languages / AECC – II Tamil/ Hindi/ French	UTAL407/ UTAL408	Basic Tamil I/ Advanced Tamil I	UTAL405/ UTAL406/ UHIL401/ UFRL401	5	3/4
	II	Communicative English /AECC – I	UENL409/ UENL410	English for Communication (Stream – I)/ English for Communication (Stream – II)	UENL407/ UENL408	5	3/4
	III	Major Core (DSC) – X	UPHM407	Atomic Physics	-	6	4
	III	Major Core (DSC) – XI	UPHR405	Major Practical IV	-	3	3
	III	Allied (GE) - V	UCHA401/ UCHA402/ UCHA403	Chemistry for Physics	-	3	3
	III	Allied (GE) - VI	UCHA402/ UCHR403	Volumetric and Organic Analysis-I	-	3	2
	IV	NME (Skill Enhancement Course)	UPHE403/ UPHE404	Electronic Communication System / Applied Electronics	-	3	2
	IV	Soft Skill (SEC)			-	2	1
	V	Extension Programme/ Physical Education/NCC			-	-	-/2
					TOTAL	**30**	**21/25**

Semester	Part	Category	Course Code	Course Title	Previous Course Code	Contact Hrs/Week	Credit Min/ Max
V	III	Major Core (DSC) – XII	UPHM507	Quantum Mechanics	-	5	5
	III	Major Core (DSC) – XIII	UPHM505	Basic Electronics	-	4	4
	III	Major Core (DSC) – XIV	UPHM506	Solid State Physics	UPHM608	4	4
	III	Major Elective (Discipline Specific Elective) - XV	UPHO501/ UPHO502	Medical Physics / Energy Physics	-	4	4
	III	Major Core (DSC) – XVI	UPHR502	Major Practical V	-	3	3
	III	Major Core (DSC) – XVII	UPHP501/ UPHP502	Project / Instrumentation Techniques	-	5	4/5
	III	Online Course		NPTEL/Spoken Tutorial	-	3	½
	IV	Value Education (SEC)			-	2	1
TOTAL						**30**	**26/28**
VI	III	Major Core (DSC) – XVIII	UPHM609	Numerical methods and Basic Computational Physics	-	5	4
	III	Major Core (DSC) – XIX	UPHM611	Nuclear and Radiation Physics	-	5	4
	III	Major Core (DSC) – XX	UPHM612	Material Science	-	5	4
	III	Major Core (DSC) – XXI	UPHM613	Digital Electronics	-	5	4
	III	Major Core (DSC) – XXII	UPHR605	Major Practical VI	-	3	3
	III	Major Elective (Discipline Specific Elective) - XXIII	UPHO601/ UPHO603/ UPHO604	Nanophysics/ Functional Materials/ Astrophysics and Special Theory of Relativity	-	5	4
	III	Viva Voce	UPHM610	Comprehensive Viva Voce	-	-	1
	IV	Soft Skill (SEC)			-	2	1
	V	Extension Program -me/Physical Education/NCC			-	-	-/2
TOTAL						**30**	**25/27**
GRAND TOTAL						**192**	**148/163**

LIST OF COURSES OFFERED TO OTHER DEPARTMENTS
NON-MAJOR ELECTIVES

Semester	Part	Category	Course Code	Course Title	Previous Course Code	Contact Hrs/Week	Credit Min/ Max
II	IV	Non Major Elective (Skill Enhancement Course)	UPHE202	Applied Physics	-	3	2
			UPHE203	Biomedical Instrumentation	-	3	2
			UPHE204	Electrical Appliances	-	3	2
			UPHE205	Telecommunication System	UPHE304 /UPHE503	3	2
			UPHE206	Servicing and maintenance of home appliances	UPHE303	3	2

ALLIED

Semester	Part	Category	Course Code	Course Title	Previous Course Code	Contact Hrs/ Week	Credit Min/ Max
I	III	Allied (GE) – I	UPHA102	Allied Physics-I	UPHA101	3	3
I	III	Allied (GE) – II	UPHR103	Physics for Chemistry Practical – I	UPHR102	3	2
II	III	Allied (GE) - III	UPHA203	Allied Physics-II	UPHA202	3	3
II	III	Allied (GE) – IV	UPHR202	Physics for Chemistry Practical – II	-	3	2
III	III	Allied (GE) – V	UPHA303	Digital Electronics for Computer Science	-	3	3
III	III	Allied (GE) – VI	UPHR303	Digital Electronics Practical for Computer Science	-	3	2
IV	III	Allied (GE) – VII	UPHA402	Electronics for Mathematics	-	3	3
IV	III	Allied (GE) – VIII	UPHR402	Electronics Practical for Mathematics	-	2	2
IV	III	Allied (GE) – IX	UPHA403	Electronics for Computer Science	-	3	3
IV	III	Allied (GE) – X	UPHR403	Electronics Practical for Computer Science	-	3	2

Inclusion of Experiential Learning

A. Experiential Learning (Mandatory)

Course Mapping				Collaborating Agency - MSME		
Semester	Course Code	Course Title	Assessment	Course Title	Hour / Days/ Month	Mode of Evaluation
IV	UPHM407	Atomic Physics	Component IV	Solar Energy	4 Days	Reflection

B. Skill Orientation Programme (Only for the interested students) – Extra Credit Earning Provision

Semester	Category	Course Code	Course Title	Collaborating Agency	Hour / Days/ Month	Mode of Evaluation	Credits (Min/Max)
V	Core	UPHT501	PCB Design	MSME	4 days	Reflection	1

PROPERTIES OF MATTER

UPHM106

Semester : I **Credit: 4**
Category : Major Core (DSC) – I **Hour/Week : 4**
Class & Major : I B.Sc., Physics **Total Hour : 65**

Objectives

To enable the students

- Understand the basics of Elasticity and its Importance in Beams and Griders.
- Apply the concepts of Surface Tension, Viscosity and their Applications.
- Analyze the Importance of Sound and its Application.

Learning Outcomes

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

- Evaluate the Strength of the Solid Materials of Different Size.
- Create the Streamline, Turbulent Flow of Liquids and Ultrasound.

UNIT – I ELASTICITY **12 Hour**

Introduction – Stress, Strain, Hooke's Law – Types of Elasticity – Poisson's Ratio – Workdone due to Strain – Relation between the Elastic Moduli – Torsion – Torsional Oscillations of a Body – Rigidity Modulus by Torsion Pendulum.

UNIT – II BENDING OF BEAMS **14 Hour**

Cantilever - Expression for Bending Moment - Expression for Depression - Cantilever Oscillations - Expression for Time Period - Experiment to find Young's Modulus - Non Uniform Bending - Experiment to determine Young's Modulus by Koenig's Method - Uniform Bending - Expression for Elevation - Experiment to determine Young's modulus using microscope.

UNIT – III SURFACE TENSION **12 Hour**

Introduction – Explanation of Surface Tension in Kinetic Theory – Surface Energy – Angle of Contact – Express Pressure inside a Liquid Drop and Soap Bubble – Variation of Surface Tension with Temperature – Drop Weight Method of Determination the S.T of a Liquid – Interfacial Tension- Experiment to Determine the Interfacial Tension between Water and Kerosene.

UNIT – IV VISCOSITY **14 Hour**

Introduction – Streamline and Turbulent Flow – Determination of Critical Velocity – Poiseuill's Formula – Correction – Poiseuill's Method for Determination Coefficient of a Liquid – Terminal Velocity – Stoke's Formula – Stoke's Method for Determination the Coefficient of Viscosity of a Liquid – Variation of Viscosity with Temperature and Pressure – Friction and Lubrication - Fick's Law of Diffusion – Analogy with Heat Conduction – Experimental Determination of Coefficient of Diffusion.

UNIT – V ACOUSTICS **13 Hour**

Forced Vibrations – Damped Vibrations – Resonance – Intensity of Sound – Noise Pollution – Transverse Vibration of a Stretched String – Expression for the Velocity of Transverse Vibration of a Stretched String – Expression for the Transverse Vibration of a Stretched String – Laws of Vibration of Strings – A.C. Frequency Measurement using Sonometer – Ultrasonics – Production of Ultrasonic Waves – Use of Ultrasonics.

Text Books

- Murugeshan, R. and Kiruthiga, S. (2010). *Properties of Matter and Acoustics*. S. Chand & Company Ltd. New Delhi.
- Murugeshan, R. (2017). *Properties of Matter*. S. Chand & Company Ltd. New Delhi.

Reference Books

- Halliday, D.R. and Walker, J. (2006). *Fundamentals of Physics*. Wiley. (6th Ed). New York.
- Murugeshan, R. (2005). *Waves and Oscillations*. S. Chand & Company Ltd. New Delhi.

E – Resources

- http://www.vssut.ac.in/lecture_notes/lecture1423904647.pdf
- https://www.win.tue.nl/~sjoerdr/papers/boek.pdf

MECHANICS

UPHM107

Semester : I **Credit: 5**
Category : Major Core (DSC) – II **Hour/Week : 5**
Class & major : I B.Sc., Physics **Total Hour : 65**

Objectives:
To enable the students

- Describe the Concepts of Different Types of Motion and Gravitation.
- Interpret the Dynamics of Rigid Bodies in Terms of Moment of Inertia.
- Apply the Basics of Fluid Mechanics and its Applications.

Learning Outcomes
On completion of the course, the students will be able to

- Relate the Elementary Mathematics along with Physical Principles to Effectively Solve Problems Encountered in Everyday Life.
- Evaluate the Dynamics of Rigid Bodies and Fluids.

UNIT – I LAWS OF MOTION **13 Hour**

Newton's Laws of Motion – Conservation of Energy-Conservation Forces-Conservation of Linear Momentum-Center of Mass – Angular Momentum – Conservation of Angular Momentum – Relation between Torque and Angular Momentum – Rocket Motion – Principle – Theory – Velocity of the Rocket at any Instant – Rocket Propulsion System – Multi Stage Rocket – Shape of the Rocket – Artificial Satellites.

UNIT – II GRAVITATION **15 Hour**

Kepler's Law – Newton's Law of Gravitation - Determination of G by Boy's Method – Density of Earth – Mass of the Earth and Sun – Gravitational Field – Intensity of the Field – Gravitational Potential – Potential Energy – Inertial and Gravitational Masses – Escape and Orbital Velocity – Acceleration due to Gravity – Value of 'g' at the Poles and at the Equator – Variation of 'g' with Latitude, Altitude & Depth – Compound Pendulum – Radius of Gyration – Determination of 'g' by Compound Pendulum.

UNIT – III CIRCULAR MOTION **13 Hour**

Angular Displacement – Angular Velocity – Relation between Linear Velocity and Angular Velocity – Acceleration in Uniform Circular Motion – Centripetal Force and Centrifugal Force – Applications – Condition for Skidding and Overturning of a Car Taking a Turn – Motion in Horizontal Circle – Friction Present on the Road – Motion in Vertical Circle – Centrifuge.

UNIT – IV MOMENT OF INERTIA **10 Hour**

Rigid body – Moment of Inertia – Parallel Axes Theorem – Perpendicular Axes Theorem – Moment of Inertia of a Thin Rod, Solid Cylinder, and Solid Sphere – Hollow Sphere with External and Internal Radii – Kinetic Energy of Rotation.

UNIT – V FLUID MECHANICS **14 Hour**

Fluid Pressure - Forces on Solid Surfaces - Buoyant Forces - Equations for Acceleration - Continuity Equation, Irrotational and Rotational Flow - Potential and Stream Functions - Equation of Continuity – Energy of the Liquid – Bernoulli's Theorem – Proof – Applications of Bernoulli's Theorem – Venturimeter – Pitot's Tube.

Text Books

- Murugeshan, R. (2008). *Mechanics and Mathematical Physics*. S. Chand & Company Ltd. New Delhi.
- Brij Lal, Subramaniam. (2002). *Properties of Matter*. Eurasia Publishing House. New Delhi.

Reference Books

- Halliday, D.R. Walker, J. (2006). *Fundamentals of Physics.* Willey. (6th Ed.). New York.
- Mathur, D.S. *Mechanics*. (2005). S. Chand & Company Ltd. New Delhi.

E – Resources

- https://salmanisaleh.files.wordpress.com/2019/02/fundamentals-of-physics-textbook.pdf
- https://people.maths.bris.ac.uk/~maxmr/Mechanics1/intro.pdf
- https://vssut.ac.in/lecture_notes/lecture1427495313.pdf

MAJOR PRACTICAL-I

UPHR102

Semester : I **Credit : 2**
Category : Core Practical I **Hours/Weeks : 3**
Class & Major : I B.Sc., Physics **Total Hours :39**

Objectives:

To enable the students

- Understand the Theory of the Application of Subject Knowledge.
- Determine the Techniques of Handling Equipments.
- Compute Error Free Measurements and Error Analysis.

Learning Outcomes

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

- Demonstrate Knowledge and Comprehension of the Basic of Physics.
- Develop Independent Problem Solving Skills.

1. Young's Modulus-Cantilever Depression Using Scale and Telescope.
2. Young's Modulus-Uniform Bending-Scale and Telescope.
3. Young's Modulus-Non Uniform Bending-Pin and Microscope.
4. Rigidity Modulus –Torsion Pendulum-(With and Without Masses).
5. Surface Tension-Capillary Rise Method-(Radius using Vernier Microscope).
6. Sonometer - A.C. Frequency-Steel and Brass Wire.
7. Co-efficient of Viscosity of a Liquid-Constant Pressure Head.
8. Sonometer-Frequency of Tuning Fork.
9. Young's Modulus-Uniform Bending-Koenig's Method.
10. Rigidity Modulus- Static Torsion.

Text Books

- Srinivasan, M.N. Balasubramanian, S. Ranaganathan, R. (2006). *The Text Book of Practical Physics*. Sultan Chand and Sons. New Delhi.
- Ouseph, C.C. Ranagarajan, G. (1990). *A Textbook of Practical Physics Part-I*. S. Viswanathan Publisher.

Reference Book

- Gupta, S.L. Kumar, V. (2002). *Practical Physics*. Pragathi Prakashan. (25th Ed.).

MAJOR PRACTICAL-II
UPHR203

Semester	**: I**	**Credit**	**:2**
Category	**: Core Practical-II**	**Hours/Week**	**: 3**
Class & major	**: I B.Sc Physics**	**Total Hours**	**: 39**

Objectives:

To enable the students

- Understand the Theory of the Application of Subject Knowledge in Practical.
- Demonstrate the Techniques of Handling Equipments.
- Make Error Free Measurements and Error Analysis.

Learning Outcomes

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

- Demonstrate Knowledge and Comprehension of the Basic of Physics.
- Develop Independent Problem Solving Skills.

1. Compound Pendulum-Acceleration due to Gravity ‘g’ and Radius of Gyration.
2. Bifilar Pendulum-Verification of M.I Theorem.
3. Specific Heat Capacity – Newton’s Law of Cooling.
4. Lee’s Disc – Thermal Conductivity of Card Board.
5. Specific Heat of a Liquid – Verification of Newton’s Law of Cooling.
6. Thermistor – Temperature Coefficient ‘’a’’ – Multimeter.
7. Thermocouple – Temperature Coefficient ‘’a’’ – Multimeter.
8. P.O Box – Temperature Coefficient of Thermistor.
9. Bifilar Pendulum – Determination of Earth’s Gravitation Field.
10. Measurement of Stefan’s Constant.

Text Books

- Srinivasan, M.N. Balasubramanian, S. Ranaganathan, R. (2006). *The Text Book of Practical Physics*. Sultan Chand and Sons. New Delhi.
- Ouseph, C.C. Ranagarajan, G. (1990). *A Textbook of Practical Physics Part-I*. S. Viswanathan Publisher.

Reference Book

- Gupta, S.L. Kumar, V. (2002). *Practical Physics*. Pragathi Prakashan. (25th Ed.).

THERMAL AND STATISTICAL MECHANICS

UPHM204

Semester : II **Credit : 4**
Category : Major Core (DSC) – IV **Hour/Week : 4**
Class & major : I B.Sc., Physics **Total Hour : 65**

Objectives:

To enable the students

- Remember the Basics Principles of Heat and Laws of Thermodynamics.
- Interpret the Importance in Liquefaction of Gases.
- Apply the Concepts of Thermodynamics in Statistical Physics.

Learning Outcomes

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

- Categorize the Applications of Thermodynamics to Heat Engines and the Working Principle of Refrigerator.
- Evaluate the Concepts of Entropy, Thermodynamic Probability and Statistical Physics.

UNIT – I TRANSMISSION OF HEAT **13 Hour**

Introduction – Coefficient of Thermal Conductivity – Lee's Disc Method – Convection – Applications of Convection – Central Heating System – Thermopile – Radiation – Thermal Radiation – Black Body – Stefan's Law – Experimental Verification of Stefan's Law – Distribution of Energy in Black Body Spectrum – Wien's Law – Rayleigh – Jeans Law – Newton's Law of Cooling – Experimental Verification of Newton's Law of Cooling – Planck's Radiation Law – Solar Constant – Temperature of the Sun – Angstrom's Pyrheliometer.

UNIT – II THERMOMETRY **13 Hour**

Definition of Temperature – Platinum Resistance Thermometer – Construction & Working – Thermistor – Specific Heat Capacity – Dulong and Petit's Law – Calorimeter – Specific Heat of a Gas – Relation between Specific Heat of a Gas – Mayer's Expression – Jolly's Differential Steam Calorimeter for Finding C_V - Callendar and Barne's Continuous Flow Method – Basis of Kinetic Theory – Maxwell's Laws of Velocity of Distribution – Experimental Verification of Maxwell Boltzmann Distribution – Degrees of Freedom – Mean Free Path.

UNIT – III LAWS OF THERMODYNAMICS **13 Hour**

Thermodynamics System – Zeroth, First, Second and Third Laws of Thermodynamics – Isothermal and Adiabatic Process – Reversible and Irreversible Process – Heat Engine – Efficiency of a Carnot's Engine – Carnot's Cycle - Carnot's Theorem - Entropy – Temperature – Entropy Diagram – Maxwell's Thermodynamic Relations – Clapeyron's Latent Heat Equation.

UNIT–IV LOW TEMPERATURE PHYSICS **13 Hour**

Introduction – Cooling by Adiabatic Expression – Joule – Thomson Expression – Liquefaction of Gases – Principle of Regenerative Cooling – Liquefaction of Helium – He I & II- Peculiar Properties of He II - Adiabatic Demagnetization – Air Conditioner – Refrigerator.

UNIT – V STATISTICAL MECHANICS **13 Hour**

Introduction – Micro and Macro States – Thermodynamic Probability – Ensembles – Derivation of Maxwell – Boltzmann Distribution Law – Application of M-B Law to Ideal Gas – Identical Particles – Derivation of Bose-Einstein Distribution Law – Application of B-E Statistics – Derivation of Fermi-Dirac Distribution Law – Applications of F-D Statistics – Comparison of Three Statistics.

Text Books

- Mathur, D.S. (2010). *Heat and Thermodynamics*. S. Chand & Company Ltd. New Delhi.
- Brij Lal, Subramaniam, Hemne, P.S. (2010). *Heat Thermodynamics and Statistical Physics*. S. Chand & Company Ltd. New Delhi.

Reference Books

- Chakrabati, P.K. (2006). *Theory and Experiments on Thermal Physics*. New Central Book Agency (P) Ltd. Kolkata.
- Rajam, J.B. and Arora, C.L. (2004). *Heat and Thermodynamics*. S. Chand & Company Ltd. New Delhi.

E – Resources

- https://www.kanchiuniv.ac.in/phy/THERMAL%20PHYSICS%20MATERIAL_KR.pdf
- http://www.fulviofrisone.com/attachments/article/485/Huang%20-%20Introduction%20to%20Statistical%20Physics,%20Taylor%20and%20Francis,%202001_305.pdf

OPTICS
UPHM205

Semester: II **Credit : 4**
Category: Major Core (DSC) – V **Hour/Week: 4**
Class: II B.Sc Physics **Total Hour: 52**

Objectives

To enable the students

- Identifying the Concepts of Dispersion, Interference, Diffraction, Polarization of Light.
- Interpret the Applications of Light in Day-to-Day Life.
- Apply the Laser Characteristics to Industry, Engineering and Medicine.

Learning Outcomes

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

- Solve Problems in Optics by Selecting the Appropriate Equations and Performing Numerical or Analytical Calculations.
- Develop the Optical Phenomenon in Various Fields.

UNIT-I GEOMETRICAL OPTICS **10 Hour**

Fermat's Principle - Dispersion of Light - Dispersive Power - Cauchy's Formula – Dispersion – Deviation without Dispersion - Dispersion without Deviation - Cardinal Points of an Optical System and their Relationships, Thick Lens and Combinations- Aberrations - Types of Aberrations - Spherical Aberration - Methods of Minimizing Spherical Aberrations - Chromatic Aberrations in Lens – Condition for Achromatism of Two Thin Lenses in Contact and Two Thin Lenses Separated – Eyepieces – Huygen's and Ramsden's Eyepieces with Comparison and its Application.

UNIT-II INTERFERENCE **11 Hour**

Introduction - Condition for Sustained Interference of Light - Young's Experiment – Theory of Interference Fringes - Fresnel's Biprism - Experimental Determination of 'λ' of Monochromatic Light and Thickness of Sheet - Colour of Thin Films – Airwedge - Experiment to Measure the Diameter of the Wire - Newton's Rings - Determination of Wavelength of Sodium Light by Newton's Rings - Determination of Refractive Index of Liquid –Michelson's Interferometer - Theory – Applications.

UNIT-III DIFFRACTION **10 Hour**

Introduction - Fresnel and Fraunhoffer Diffraction - Construction of Half-Period Zones - Zone Plate - Principle – Theory - Diffraction at a Circular Aperture - Fraunhoffer Diffraction at a Single Slit

- Plane Transmission Diffraction Grating - Dispersive Power of a Grating - Determination of Wavelength of Light using Transmission Grating (Normal Incidence).

UNIT-IV POLARISATION **11 Hour**

Polarisation of Light - Brewster's Law - Double Refraction - Nicol Prism - Quarter Wave Plate - Half Wave Plate - Production and Detection of Plane, Circularly and Elliptically Polarized Light - Optical Activity -Specific Rotation - Laurent's Half-Shade Polarimeter.

UNIT-V MODERN OPTICS **10 Hour**

Laser: Introduction - Characteristics of Laser Light- Spontaneous and Stimulated Emission-Population Inversion-Pumping - Lasing Action - Ruby Laser - He-Ne Laser – Applications - Fibre Optical Communication - Holography**.**

Text Books

- Murugeshan, R. Kiruthiga, S. (2010). *Optics and Spectroscopy*. S. Chand and Company Ltd. (7th Revised Ed.). New Delhi.
- Brijlal, N. Subramaniam, S. (2008). *A Text Book of Optics*. Chand and Company Ltd. New Delhi.

Reference Books

- Johnson, B.K. (2012). *Optics and Optical Instruments: An Introduction*. Dover Publications. Kindle Edition. (3rd Revised Ed.). New York.
- Laud, B.B. (2009). *Lasers and Non-Linear Optics*. New Age International Publishers. New Delhi.

E – Resources

- https://www.fisica.net/optica/optics_textbook.pdf
- http://www.fulviofrisone.com/attachments/article/404/Introduction%20to%20Modern%20Optics.pdf

ALLIED PHYSICS-I

UPHA102

Semester : I **Credit : 3**
Category : Allied I **Hour/Week : 3**
Class & Major :I B.Sc Chemistry **Total Hour : 39**

Objectives

To enable the students

- Gain Knowledge of basics of Particle Dynamics and Properties of Matter.
- Understand Diffraction and Polarization of Light Waves.
- Acquire Knowledge on Crystal Diffraction.

Learning Outcomes

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

- Demonstrate Knowledge and Comprehension of the Basic and Applied Fields of Physics.
- Develop Independent Problem Solving Skills.

UNIT – I PARTICLE DYNAMICS **7 Hour**

Displacement, Velocity and Acceleration – Distance-Time Graph – Velocity-Time Graph – Projectile Motion – Uniform Circular Motion – Tangential Acceleration in Circular Motion – Relative Velocity and Acceleration.

UNIT – II GRAVITATION **7 Hour**

Kepler's Laws - Newton's Law of Gravitation – 'g' and Measurement – Earth-Moon System - Earth Satellites – Parking Orbit – Earth Density – Mass of the Sun – Gravitational Potential – Velocity of Escape – Satellite Potential and Kinetic Energy.

UNIT – III PROPERTIES OF MATTER **9 Hour**

Elastic Properties: Elastic Limit – Hooke's Law – Moduli of Elasticity – Poission's Ratio – Relation between q,n,k – Force in a Bar due to Contraction or Expansion – Energy Stored in a Wire – Rigidity Modulus – Torsion in a Wire – Static Torsion and Torsional Oscillations Method.

Viscosity and Surface Tension: Newton's Formula – Stoke's Formula – Poiseuille's Flow – Molecular Theory of Surface Tension – Excess Pressure over Curved Surface – Spherical and Cylindrical Drops – Surface Energy – Capillary Rise – Quincke's Method for Mercury.

UNIT – IV OPTICS **9 Hour**

Diffraction: Fresnel and Fraunhoffer Diffractions – Fraunhoffer Diffraction at a Single Slit - Diffraction at Multiple Slits - Plane Diffraction Grating – Determination of Wavelength of a Spectral Line of a Hg Lamp.

Polarisation: Double Refraction of Crystals – Geometry of Nicol Prism – Huygen's Theory – Polaroid – Circular and Elliptical Polarization – Quarter and Half Wave Plates – Production and Analysis of Polarized Beams – Optical Activity.

UNIT – V CRYSTAL PHYSICS **7 Hour**

Crystal structures: Introduction – Crystal Lattice – Unit Cell – Classification of Crystals – Bravais Lattice in Three Dimensions –Crystal Planes and Miller Indices – Simple Crystal Structures.

Crystal diffraction: Bragg's Law – Experimental X-Ray Diffraction Methods - Laue Method – Rotating Crystal Method – Powder Method.

Text Books

- Narayanamurthy M. and Nagararathnam, N. (2004). *Dynamics*. National Publishing House. New Delhi.
- Mathur, D.S. (2012). *Properties of Matter*. S. Chand and Company. New Delhi.

Reference Books

- Halliday, D. and Resnick, R. (2006). *Fundamentals of Physics*. Wiley. (6th Ed.). New York.
- Brijlal, N. Subramaniam. *(*2008). *A Text Book of Optics*. S. Chand & Company Ltd. New Delhi.

PHYSICS FOR CHEMISTRY PRACTICAL – I

UPHR103

Semester : I **Credit : 2**
Category : Allied Practical I **Hour/Week : 3**
Class & Major : I B.Sc Chemistry **Total Hour : 39**

Objectives

To enable the students

- Understand the Theory of the Application of Subject Knowledge in Practical.
- Understand the Techniques of Handling Equipments.
- Make Error Free Measurements and Error Analysis.

Learning Outcomes

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

- Develop Experimental Technique, Including proper setup and Care of Equipment.
- Analyze Results in Order to Observe Physical Phenomena, Assess Experimental.

1. Young"s Modulus by Strenching – Vernier Microscope.
2. Rigidity Modulus – Torsional Pendulum.
3. Young"s Modulus by Non-Uniform Bending.

4. Surface Tension and Interfacial Tension – Method of Drops.
5. Surface Tension – Capillary Rise.
6. Viscosity – Capillary Flow.
7. Specific Heat of Liquid – Newton's Law of Cooling.
8. Sonometer – Verification of Laws of Vibration.
9. Compound bar Pendulum –Determination of 'g' and Radius of Gyration.
10. Specific Heat of Liquid – Electrical Heating.

Text Books

- Srinivasan, M.N. Balasubramanian, S. Ranaganathan, R. (2006). *The Text Book of Practical Physics*. Sultan Chand and Sons. New Delhi.
- Ouseph C.C. Ranagarajan, G. (1990). *A Textbook of Practical Physics Part-I*. S. Viswanathan Publisher.

Reference Book

- Gupta, S.L. and Kumar, V. (2002). *Practical Physics*. Pragathi Prakashan. (25th Ed.).

ALLIED PHYSICS -II

UPHA203

Semester : II **Credit : 3**
Category : Allied II **Hour/Week : 3**
Class & Major : I B.Sc Chemistry **Total Hour : 39**

Objectives

To enable the students

- Aware of Semiconductor Devices and their Working Principle.
- Study the Basic Number System, Digital Gates, Flip Flops, Counters and Registers.
- Acquire the Knowledge of Atom Model, Quantum Numbers and Periodic Table.

Learning Outcomes

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

- Demonstrate Knowledge and Comprehension of the Electronic Components & Application the Modern Physics.
- Know the Importance of Nucleus and Ultrasonics.

UNIT – I SEMICONDUCTOR DEVICES **8 Hour**

Semiconductor- Intrinsic and Extrinsic Semiconductor - Fermi Level-Mechanism of Current Conduction - PN - Junction Diode - Zener Diode-LED- Solar Cell - Transistor: Construction-Mechanism of Amplification- Current Components- Modes of Operation-Transistor Amplifier.

UNIT – II DIGITAL ELECTRONICS **7 Hour**

Number System- Binary – Octal-Hexadecimal-Digital Gates-Boolean Algebra – K-Map-RS-Flip Flop-JK- Flip Flop- Shift Register- Full and Half Adder-Binary Counter-Modulus Counter-Decade Counter.

UNIT –III ATOMIC PHYSICS **8 Hour**

Atomic Physics: Bohr's Atom Model- Hydrogen Spectrum-Fine Structure Splitting- Sodium Doublet-Quantum Numbers- Pauli's Exclusion Principle-Periodic Table.

X-ray and Photoelectric Effect: Production of X- Ray – Continuous and Characteristics – X-Ray Spectra – Industrial and Medical Applications of X-Rays. Law of Photoelectric Emission-Einstein's Photoelectric Equation- Millikan's Experiment-Photoelectric Cells (Emissive, Electric and Voltaic) –Photo Multiplier Tubes.

UNIT –IV NUCLEAR PHYSICS **7 Hour**

General Properties of Nuclei: Nuclear Mass and Binding Energy –BE/A versus A Curve- Nuclear Spin and Magnetic Moment- Mass, Half Life and Spin of Neutron-Semi Empirical Mass Formula- Nuclear Models and Elementary Particles – Nuclear Reactions: Cross Section- Nuclear Fission- Liquid Drop Model- Nuclear Forces-Elementary Particles: Classification- Quarks and Lepton

UNIT –V MECHANICAL WAVES **9 Hour**

Waves in Strings and Pipes: Velocity of a Transverse Wave along a Stretched String – Velocity of Sound in Gases- Newton's Formula for Velocity of Sound-Effect of Temperature, Pressure, Humidity and Density of Medium on Sound.

Ultrasonic and Acoustics: Ultrasonics - Piezo Electric Effect-Detection of Ultrasonics-Applications- Reverberation Time and Sabine's Law- Measurement of Noise – Reduction and Sound Insulations.

Text Books

- Brijlal, and Subramaniyam, (1995). *Electricity and Magnetism*. Ratan Prakash Mandir Publisher.
- Mani, H.S. Mehta. (1998). *Introduction to Modern Physics*. G.K Publication. Affiliated East-West Press Ltd. New Delhi.

Reference Books

- Richard, P. Feynman, Leighton, R.B. and Mathew S. (2005). *Feynman Lectures on Physics Series*. Vol, 1,2 and 3. Narosa Publishing. (8th Reprint). New Delhi.
- Khanna, R. and Bedi, R.S. (1985). *Text Book of Sound*. Atma Ram and Sons. New Delhi.

PHYSICS FOR CHEMISTRY PRACTICAL – II

UPHR202

Semester : I **Credit : 2**
Category : Allied Practical I **Hour/Week : 3**
Class & Major : I B.Sc Chemistry **Total Hour : 39**

Objectives:

To enable the students

- Understand the Theory of the Application of Subject Knowledge in Practical.
- Apply Techniques of Handling Equipments.
- Make Error Free Measurements and Error Analysis.

Learning Outcomes

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

- Develop Experimental Technique, Including proper setup and Care of Equipment.
- Analyze Results in Order to Observe Physical Phenomena, Assess Experimental.

1. Determination of Young's Modulus (Non-Uniform Bending) – Pin and Microscope.
2. Determination of Rigidity Modulus (Pointer Method) – Static Torsion.
3. Determination of Focal Length – Concave and Convex Lenses.
4. Determination of Thickness of Wire – Air Wedge.
5. Universal Building Block – NAND Gates.
6. Determination of Wavelengths (Grating) – Hg Spectrum.
7. LCR Parallel Resonant Circuit.

8. Characteristics of Zener Diode.
9. Construction of Half and Full Adders – Digital Gates.
10. Determination of Velocity of Sound Waves – Melde' String.

Text Books

- Srinivasan, M.N. Balasubramanian, S. Ranganathan, R. (2006). *The Text Book of Practical Physics.* Sulthan Chand & Sons. New Delhi.
- Ouseph, C.C. Rangarajan, G. (1990). *A Text Book of Practical of Physics Part – I.* S. Vishvanathan Publisher.

Reference Book

- Gupta, S.L. Kumar, V. (2002). *Practical Physics*. Pragathi Prakashan. (25th Ed.).

APPLIED PHYSICS

UPHE202

Semester: II **Credit : 2**
Category: Non Major Elective **Hour/Week: 3**
Class & Major: I UG **Total Hour : 52**

Objectives:

To enable the students

- Understand the Knowledge of Semiconductors.
- Gain the Knowledge of ICs Fabrication.
- Acquire Basics of Laser.

Learning Outcomes

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

- Demonstrate Knowledge and Comprehension of the Electronic Components & Application the Spintronics.
- Know the Importance of Semiconductor and Laser.

UNIT- I SPINTRONICS **11 Hour**

Spintronics-Introduction-Metals based Spintronic Devices-Applications-Semiconductor- Based Spintronic Devices -Applications-Spin Pumping-Spin Transfer.

UNIT-II PHOTONICS **10 Hour**

Photonics-Introduction-Photo Detectors-p-n Photo Diode-Avalanche Photo Diode-Photo Transistors-Photo Conductive Detectors.

UNIT- III SEMICONDUCTORS **11 Hour**

Semiconductors-Carrier Scattering and Mobility-Drift Current and Conductivity-Thermistors and Piezo Resistors- Thermoelectric Effect.

UNIT-IV LASER AND ITS APPLICATION **10 Hour**

LED- Laser- Optical Pumping- Population Inversion- Ruby Laser-CO_2 Laser-He-Ne Laser-Photoconductors- Solar Radiation-Thin Film Solar Cell-Superconductivity.

UNIT-V BASIC ELECTRONICS **10 Hour**

IC Fabrication- Fabrication of BJT,FET, Monolithic Diodes, Contacts IC Resistors and Capacitors, IC Packaging, Characteristic of IC Components.

Text Books

- Charles, Kittel. (2003). *Solid State Physics*. Wiley Eastern Ltd.
- Murugeshan, R. (2006). *Optics & Spectroscopy*. S. Chand & Co. New Delhi.

Reference Books

- Shur, M. (2001). *Physics of Semiconductor Devices*. PHI Publication.
- Mani, H.S. Mehta. (1998). *Introduction to Modern Physics*. G.K Publication. Affiliated East-West Press Ltd. New Delhi.

III & IV EVALUATION COMPONENTS OF CIA

Semester	Part	Category	Course Code	Course Title	Component-III	Component-IV
I	III	Major Core (DSC)–I	UPHM106	Properties of Matter	Seminar	Presentation
	III	Major Core (DSC)–II	UPHM107	Mechanics	Assignment	Assignment
II	III	Major Core (DSC)–IV	UPHM204	Thermal and Statistical Physics	Seminar	Poster
	III	Major Core (DSC)–V	UPHM205	Optics	Seminar	Working model

ALLIED COURSE

Semester	Part	Category	Course Code	Course Title	Component III	Component IV
I	III	Allied	UPHA102	Allied Physics -I	Seminar	Presentation
II	III	Allied	UPHA203	Allied Physics -II	Seminar	Presentation

NON MAJOR ELECTIVE COURSE

Semester	Part	Category	Course Code	Course Title	Component III	Component IV
II	IV	NME	UPHE202	Applied Physics	Seminar	Presentation

PROGRAMME PROFILE M.Sc., PHYSICS

PROGRAMME SPECIFIC OUTCOMES (PSO)

After two years of completion of the M.Sc., Programme, the Graduates will

- Understand the Challenges of a Dynamically and Globalised Changing World Adapting their Skills through Continuous Learning and Self-Improvement.
- Improving the Employability Skills by Facilitating Activities to Enrich the Path towards Higher Learning and Employment.
- Exposing to New Learning Methods Involving Active Learning Experience such as Learning Outside the Class Rooms, Internships, Industry/ Institutional Visits, Training Programs, etc.

Semester	Category	Course Code	Course Title	Previous Course Code	Contact Hrs/Week	Credit Min/ Max
I	Core I	PPHM101	Mathematical Physics I	-	6	5
	Core II	PPHM107	Classical Mechanics	PPHM102	7	6
	Core III	PPHM105	Electronics	-	6	4
	Core IV	PPHM106	Molecular Spectroscopy	PPHM203	6	5
	Core V	PPHR101	General Practical – I	-	5	3
				Total	**30**	**23**
II	Core VI	PPHM205	Mathematical Physics II	PPHM401	5	4
	Core VII	PPHM201	Quantum Mechanics I	-	5	5
	Core VIII	PPHM208	Electromagnetic Theory	PPHM104	5	3
	Core IX	PPHM207	Solid State Physics I	PPHM302	5	3
	Core X	PPHR203	Electronics Practical	-	5	3
	NME	PPHE201	Nanoscience	PPHE101	5	4
	Service Learning	PPHX201	Energy Audit	-	-	1
	Extra Credit	PPHS201	Spoken Tutorial / NPTEL	-	-	-/2
				Total	**30**	**23/25**
III	Core XI	PPHM301	Quantum Mechanics II	-	5	5
	Core XII	PPHM306	Crystal Growth and its Technology	-	4	3
	Core XIII	PPHM307	Statistical Mechanics	PPHM202	4	4
	Core XIV	PPHP301	Project	-	2	-
	Core XV	PRMC301	Research Methodology	-	5	4
	Core XVI	PPHR303	Numerical Practical – III	-	5	3
	Core XVII	PIDM301	Sustainable Materials and Technologies	-	5	5
				Total	**30**	**24**
IV	Core XVIII	PPHM406	Laser and Nonlinear Optics	PPHM303	6	4
	Core XIX	PPHM402	Nuclear and Particle Physics	-	7	4
	Core XX	PPHM403	Solid State Physics-II	-	7	4
	Core XXI	PPHM407	Microprocessor and Microcontroller	PPHM302	6	4
		PPHP401	Project	-	4	4
				Total	**30**	**20**
				GRAND TOTAL	**120**	**90/92**

MATHEMATICAL PHYSICS-I

PPHM101

Semester : I **Credit : 5**
Category : Core I **Hour/Weeks : 6**
Class & Major : I M.Sc., Physics **Total Hour : 65**

Objectives:

To enable the students

- Acquire Mathematical Knowledge and Apply it to various Physical Phenomena.
- Develop Problem Solving Ability related to Physical Problems.
- Enhance basic Skills of Learning and Appreciating Physics through Mathematics.

Learning Outcomes

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

- Apply the concepts of Calculus, Vector Analysis, Vector Calculus, Fourier Series, Special Functions.
- Solve various Physics Problems using Mathematical Techniques.

UNIT – I VECTOR ANALYSIS **13 Hour**

Concept of Vector and Scalar Fields – Gradient, Divergence, Curl and Laplacian – Vector Identities – Line Integral, Surface Integral and Volume Integral – Gauss Theorem, Green's Theorem, Stoke's Theorem and Applications – Orthogonal Curvilinear Coordinates – Expression for Gradient, Divergence, Curl and Laplacian in Cylindrical and Spherical Co-ordinates - Definitions – Linear Independence of Vectors – Schmidt's Orthogonalisation Process – Schwartz Inequality.

UNIT – II COMPLEX ANALYSIS **12 Hour**

Functions of Complex Variables – Differentiability - Cauchy-Riemann Conditions – Complex Integration – Cauchy's Integral Theorem and Integral Formula – Taylor's and Laurent's Series – Residues and Singularities - Cauchy's Residue Theorem – Evaluation of Definite Integrals - Derivatives of Analytic Functions -Calculus of Residues.

UNIT – III FOURIER SERIES AND LAPLACE TRANSFORMS **13 Hour**

Fourier Series-Dirichlet's Theorem-Change of Interval-Complex Form-Fourier Series in the Interval $(0, \infty)$ - Uses of Fourier Series-Laplace Transform-Definition-Properties-Translation Property-Inverse Laplace Transform-Properties, Example Problems.

UNIT – IV PARTIAL DIFFERENTIAL EQUATIONS **14 Hour**

Homogeneous and Non-Homogeneous Equations of First and Second Order Partial Differential Equations Separation of Variables Technique-Solution by Fourier Series-Use of Double Fourier Series. Applications: (1) One dimensional Wave Equation (2) One Dimensional Heat Flow Equation (Separation of Variables and Use of Fourier Series) (3) Two Dimensional Laplace's Equation in Cartesian Coordinate (Separation of Variables and Double Fourier Series.)

UNIT – V SPECIAL FUNCTIONS **13 Hour**

Sturm-Liouville Problem – Orthogonal Functions - Legendre, Associated Legendre, Bessel, Laugerre and Hermite Differential Equations: Series Solution – Rodriguez Formula – Generating Functions – Orthogonality Relations – Important Recurrence Relations- Gamma and Beta Functions.

Text Books

- Erwin Kreyzig. (2005). *Advanced Engineering Mathematics*. Publishers-John Wiley & Sons. Inc. (8^{th} Ed.).
- Joshi, A.W. (1997). *Group Theory for Physicists.* Wiley Eastern Limited. (2^{nd} Ed.).
- Spiegel, M.R. (2000). *Theory and Problems of Fourier Analysis*. Schaum's Outline Series.

Reference Books

- Murray R. Spiegel. (2000). *Theory and Problems of Fourier Analysis with Applications to Boundary Value Problems.* Mchraw Hill Book Company.
- Sankara Rao K. (2005). *Introduction to Partial Differential Equations.* Prentice Hall of India. (2nd Ed.).
- Greenberg, M.D. (2002). *Advanced Engineering Mathematics.* Publishers-Pearson Education (Singapore). Pvt. Ltd. (2nd Ed).

CLASSICAL MECHANICS

PPHM107

Semester : I **Credit:6**
Category : Core II **Hour/Weeks: 7**
Class & Major : I M.Sc., Physics **Total Hour : 65**

Objectives:

To enable the students

- Understand the Drawbacks of Newtonian Approach and Necessity of New Approaches to Solve Advanced Problems Involving the Dynamic Motion of Classical Mechanical Systems.
- Apply the Basic Concept in Nonlinear Dynamics.

Learning Outcomes

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

- Solve the Lagrangian Dynamics, Hamiltonian Mechanics, Lorentz Transformations, Special Theory of Relativity and Nonlinear Dynamical Problems.
- Create the Necessary Mathematical Equations.

UNIT – I FUNDAMENTAL PRINCIPLES AND MATHEMATICAL FORMULATION 13 Hour

Mechanics of a Particle and System of Particles – Conservation Laws – Constraints – Generalized Coordinates – D' Alembert's Principle and Lagrange's Equation – Hamilton's Principle – Lagrange's Equation of Motion – Conservation Theorems and Symmetry Properties – Motion Under Central Force : General Features.

UNIT – II LAGRANGIAN AND HAMILTONIAN FORMULATIONS 14 Hour

Hamilton's Variational Principle - Lagrange's Equations of Motion –Conservation Theorems and Symmetry Properties – Cyclic Coordinates - Application of Lagrange's Equation - Linear Harmonic Oscillator, Particle Moving under a Central Force, Atwood's Machine - Hamilton's Equations of Motion - Application of Hamiltonian's Equations of Motion - Particle Moving in an Electromagnetic Field - Phase Space - Principle of Least Action Lagrange and Poisson Brackets – Hamilton – Jacobi Method – Action Angle Variables – Kepler Problem in Action – Angle Variables.

UNIT - III RIGID BODY DYNAMICS AND OSCILLATORY MOTION 12 Hour

Euler Angles – Moments and Products of Inertia – Euler's Equations – Symmetrical Top – Applications – Theory of Small Oscillations and Normal Modes – Frequencies of Free Vibration and Normal Coordinates – Linear Triatomic Molecule.

UNIT - IV RELATIVISTIC MECHANICS 12 Hour

Algebra of Tensors – Quotient Law – Fundamental Tensor – Cartesian Tensors – Four Vectors in Special Theory of Relativity – Lorentz Transformations in Real Four Dimensional Spaces, Covariant Four Dimensional Formulations – Force and Energy Equations in Relativistic Mechanics – Lagrangian and Hamiltonian Formulation of Relativistic Mechanics.

UNIT - V NONLINEAR DYNAMICS **14 Hour**

Linear and Nonlinear Systems– Linear Superposition Principle – Linear Wave Propagation (Non Dispersive and Dispersive) –Fourier Transform and Solution of Initial Value Problem– Wave Packet and Dispersion–Nonlinear Dynamical Systems – Korteweg-de Vries Equation and the Solitary Waves and Cnoidal Waves– Hirota's Direct Method and N Soliton Solution – Introduction to Chaos.

Text Books

- Goldstein, H. Poole, C. Safko, J. (2002). *Classical Mechanics.* Addison Wesley. New Delhi.
- Lakshmanan, M. and Rajasekar, S. (2003). *Nonlinear Dynamics, Integrability, Chaos and Patterns*. Springer.

Reference Books

- Gupta, Kumar, Sharma, (2002). *Classical Mechanics.* Pragati Bhawan. Meerut. *(*22nd Ed.).
- Awrejcewicz, J.A. (2016). *Applied Nonlinear Dynamical Systems*: 93. Springer. (1st Ed.).

E – Resources

- https://www.physics.upenn.edu/sites/default/files/Classical_Mechanics_a_Critical_Introduction_0_0.pdf
- http://www.fulviofrisone.com/attachments/article/464/Strogatz,%20S.H.%20-%20Nonlinear%20dynamics%20and%20chaos.pdf

ELECTRONICS

PPHM105

Semester : I **Credit: 4**
Category : Core III **Hour/Weeks : 6**
Class & Major: I M.Sc., Physics **Total Hour : 65**

Objectives:

To enable the students

- Remember the Basic and Advanced Electronic Concepts.
- Understand how to Design Circuits which can Process Digital Data.
- Establish the various Principles of Analog Electronics and its Applications.

Learning Outcomes

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

- Recognise a variety of Exciting High-Tech Products and Systems Enabled by Electronics.
- Manipulate Voltages, Currents and Resistances in Electronic Circuits.
- Demonstrate Familiarity with Basic Electronic Components and Use them to Design Simple Electronic Circuits.

UNIT – I OPERATIONAL AMPLIFIERS **13 Hour**

Ideal Op-Amp-Inverting, Non-Inverting, Logarithmic, Summing and Difference Amplifiers-Integrator - Differentiator- Comparator-CMRR – Op-Amp Applications- Summing Amplifiers-Application of Summing Amplifiers.

UNIT – II UJTS AND THYRISTORS **14 Hour**

Operational Principle of UJT- Characteristics- SCR- V-I Characteristics –TRIAC- Thyristors: Basic Parameters- Current Controllable Devices- Thyristors in Series and Parallel- Applications of Thyristors - TRIAC based AC Power Control - Bistable Multivibrator, Half and Full Wave Controlled Rectifier.

UNIT – III DIGITAL INTEGRATED CIRCUITS **12 Hour**

7400 TTL- TTL Parameters; TTL-MOSFET - CMOS FET - Three State TTL Devices-External Drive for TTL Loads - TTL Driving External Loads-74C00 CMOS- CMOS Characteristics-TTL to CMOS Interface- CMOS to TTL Interface- Current Tracers.

UNIT – IV ANALOG INTEGRATED CIRCUITS **13 Hour**

Electronic Analog Computation- Active Filters- High/Low Pass Filter-Band Pass Filter-Band Reject Filter- Delay Equalizer- Switched Capacitor Filters; Comparators- Sample and Hold Circuits-Waveform Generators- Square Wave Generator- Triangle Wave Generator-Sawtooth Generator.

UNIT-V INTEGRATED CIRCUITS AS DIGITAL SYSTEM **13 Hour**

Binary Adders- Half / Full Adder- - MSI Adder-Serial/Parallel Operation-Decoder/Demultiplexer- BCD to Decimal Decoder-4-to-16 line Demultiplexer- Data Selector/Multiplexer-16-to-1 Multiplexer; Encoder; ROM: Code Converters-Programming the ROM-Applications-Basic RAM Elements-Bipolar RAM-Static and Dynamic MOS RAM- Ladder Type D/A Converter-Multiplying D/A Converter.

Text Books

- Chattopadhyay, S. (2006). *Text Book of Electronics*. New Central Book Agency P.Ltd. Kolkata.
- Malvino, A.P. Leach, D.P. (2005). *Digital Principles and Applications*. Tata McGraw-Hill. Publishing Co. New Delhi.

Reference Books

- Bhattacharya, A.B. (2007). *Electronics Principles and Applications*. New Central Book Agency P.Ltd. Kolkata.
- Jacob Millman, Christos C Halkins and Chetan Parikh. (2010). *Integrated Electronics Analog and Digital Circuits and Systems*. Tata McGraw Hill Educatio Private Ltd. New Delhi.
- Anil K. Maini and Varsha Agarwal. (2009). *Electronic Devices and Circuits*. Wiley India Pvt. Ltd. New Delhi.

MOLECULAR SPECTROSCOPY

PPHM106

Semester : I **Credit: 5**
Category : Core V **Hour/Weeks : 6**
Class & Major : I M.Sc., Physics **Total Hour : 65**

Objectives:

To enable the students

- Acquire the Knowledge of Interaction Electromagnetic Radiation with Atoms and Molecules and Study the Different Types of Spectra.
- Know the Spectroscopic Techniques to use in finding the Molecular Structure, Bond Angles, Bond Length etc.
- Analyze the Use of Spectroscopic Methods for Qualitative and Quantitative.

Learning Outcomes

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

- Describe the Desirable Features of a Radiation Source.
- Able to Analyze Results of Measurements using Molecular Spectroscopy Methods.

UNIT – I MICROWAVE SPECTROSCOPY **13 Hour**

Rotation of Molecules-Rotational Spectra-Rigid and Non-Rigid Diatomic Rotator-Intensity of Spectral Lines-Isotopic Substitution-Poly Atomic Molecules (Linear and Symmetric Top)-Hyperfine Structure and Quadrupole Effects-Inversion Spectrum of Ammonia-Chemical Analysis by Microwave Spectroscopy-Techniques and Instrumentation.

UNIT – II VIBRATIONAL SPECTROSCOPY **14 Hour**

Infrared spectroscopy-Vibration of Molecules-Diatomic Vibrating Rotator-Vibrational Rotational Spectrum-Interactions of Rotations and Vibrations-Influence of Rotation on the Vibrational Spectrum of Linear and Symmetric Top and Poly Atomic Molecules-Analysis by Infrared Techniques-Instrumentation-FTIR Spectroscopy -Raman Spectroscopy: Classical and Quantum Mechanical Picture of Raman Effect-Pure Rotational Raman Spectrum -Raman Activity of Vibrations of CO_2 and H_2O Rule of Mutual Exclusion- Vibrations of Spherical Top Molecule-Structural Determination from IR and Raman Spectroscopy Techniques and Instrumentation-FT Raman Spectroscopy

UNIT – III ELECTRONIC SPECTROSCOPY **12 Hour**

Electronic Spectra-Frank-Condon Principle-Dissociation Energy and Dissociation Products-Fortrat Diagram- Predissociation-Shapes of some Molecular Orbits- Chemical Analysis by Electronic Spectroscopy-Techniques and Instrumentation-Mass Spectroscopy-ESR Spectroscopy-Introduction-Techniques and Instrumentation-Double Resonance.

UNIT – IV NUCLEAR RESONANCE SPECTROSCOPY **13 Hour**

Nuclear Magnetic Resonance Spectroscopy-Introduction-Interaction of Spin and Magnetic Field-Population of Energy Levels- Larmor Precession-Relaxation Times-Chemical Shift and its Measurement-Coupling Constant-Coupling between Several Nuclei-Quadrupole effects-C^{13} NMR Spectroscopy-Mossbauer Spectroscopy: Principle-Instrumentation-Effect of Electric and Magnetic Fields.

UNIT - V SURFACE SPECTROSCOPY **13 Hour**

Electron Energy Loss Spectroscopy (EELS)-Reflection Absorption Spectroscopy (RAIRS)-Photoelectron Spectroscopy (PES)- XPES, UPES-Auger Electron Spectroscopy (AES) X-Ray Fluorescence Spectroscopy (XRF)-SIMS.

Text Book

- Colin N. Banwell and Elaine M. (2013). *Fundamentals of Molecular Spectroscopy.* Tata McGraw-Hill Publishing Company Ltd. (5^{th} Ed.).

Reference Book

- Jack D. Graybeal. (2014). *Molecular Spectroscopy*. Mc Graw Hill Education.

PRACTICALS

GENERAL PRACTICAL

PPHR101

Semester : I **Credit: 3**
Category : Core V **Hour/Week : 5**
Class & Major : I M.Sc., Physics

Objectives:

To enable the students

- Understand the Theory of the Application of Subject Knowledge in Practical.
- Analyze the Techniques of Handling Equipments.

Learning Outcomes

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

- Analyze the Effects of Refractive Index of a Medium using Optical Instruments.
- Make Error Free Measurements and Error Analysis

1. Determination of q, n, b by Elliptical Fringes Method.
2. Determination of Planck's Constant.

3. Determination of Stefan's Constant.
4. Dielectric Constant of Material to Study the Susceptibility of Material.
5. Determination of Velocity of given Liquid using Ultrasonic Interferometer.
6. Demonstration of Hall Coefficient.
7. Determination of Laser Beam Parameter.
8. Spectrometer i-i' Curve.
9. Determination of Refractive Index of Liquids using Biprism (by Scale & Telescope method).
10. Determination of Wavelength of Monochromatic Source using Biprism.

Text Books

- Balasubramanian, S. Ranganathan, R. Srinivasan, M.N. (2019). *A Text Book of Practical Physics*. Sultan Chand and Sons. New Delhi.
- Arora, C.L. (2010). *Practical Physics*. S. Chand. Kindly. India.

Reference Book

- Gupta, S.L. and Kumar, V. (2017). *Practical Physics*. Pragathi Prakashan. (24th Ed.,).

E – Resources

- https://www.msuniv.ac.in/Download/Pdf/b2efcbdbc4be452
- https://blog.acadly.com/h-c-verma-the-man-who-taught-india-physics-b8fc4ed24d7d

MATHEMATICAL PHYSICS-II

PPHM205

Semester : II **Credit : 4**
Category : Core VI **Hour/Weeks : 5**
Class & Major: II M.Sc., Physics **Total Hour : 65**

Objectives:

To enable the students

- Understand the various Mathematical Representations.
- Acquire Knowledge about the Tensor Analysis.
- Formulate the Greens Function and Probability

Learning Outcomes

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

- Apply the concepts of Probability, Matix, Group Theory, Tensor Analysis and Greens Function.
- Solve various Physics Problems using Mathematical Techniques.

UNIT- I PROBABILITY **13 Hour**

Probability - Addition rule of Probability - Multiplication Law of Probability - Probability Distributions - Binomial distribution - Mean Binomial Distribution - Standard Deviation of Binomial Distribution - Poisson Distribution - Normal Distribution - Characteristics of Normal Distribution - Applications of Normal Distribution.

UNIT- II APPLICATION IN MATRICES AND DETERMINANTS **13 Hour**

Properties of Matrix Addition and Multiplication – Different type of Matrices and their Properties – Rank of a Matrix and some of its Theorems – Solution to Linear Homogeneous and Non-Homogeneous Equations – Cramer's Rule – Eigenvalues and Eigenvectors of Matrices – Differentiation and Integration of Matrix.

UNIT - III ROLE OF GROUP THEORY IN PHYSICS **13 Hour**

Definition of Group – Subgroup Invariant Group Abelian Group Orthogonal and Unitary Groups - Homomorphism, Isomorphism - Reducible and Irreducible Representations -Generators of Continuous Groups.

UNIT – IV TENSOR ANALYSIS **13 Hour**

Definition of Tensor – Coordinate Transformation - Summation Convention - Contravariant, Covariant and Mixed Tensors – Rank of Tensor – Addition and Subtraction of Tensors –Symmetry and antisymmetry Tensor – Contraction of Tensor – Product Rule and Quotient Rule- Invariant Tensors – Kronecker delta and Levi-Civita Symbol - Irreducible Tensors.

UNIT –V GREEN'S FUNCTIONS **13 Hour**

Green's Function - One Dimensional Green Function – Boundary Conditions – Eigen Function - Expansion of the Green's Function- Reciprocity Theorem – Sturm Liouville Type Equations in One Dimension and their Green's Functions.

Text Books

- Arfken, Weber. (2012). *Mathematical Methods for Physicists.* - Elsevier (7th Ed.). US.
- Joglekar, S.D. (2005). *Mathematical Physics.* Universities Press Pvt. Ltd. (1st Ed.). Hydrabad.
- Satya Prakash. (2014). *Mathematical Physics*. Sultan Chand & Sons. (6th Revised Ed.). New Delhi.

Reference Books

- Dass, H.K. and Verma, R. (2011). *Mathematical Physics*. S. Chand & Company. (4th Ed.).
- Erwin Kreyszig. (2010). *Advanced Engineering Mathematics*, Wiley Eastern, (10th Ed.).
- Gupta, B.D. (2006). *Mathematical Physics*. Vikas Publishing House Pvt. Ltd. (3rd Ed.).
- Joshi, A.W. (2010). *Elements of Group Theory of Physicists*. Wiley Eastern Ltd.

QUANTUM MECHANICS I

PPHM201

Semester : II **Credit : 5**
Category : Core VII **Hour/Weeks : 5**
Class & Major: I M.Sc., Physics **Total Hour : 65**

Objectives

To enable the students

- Understand basic Idea of Dirac Formalism to Quantum Mechanics.
- Apply the same Formalism to study the Angular Momentum Concept, Scattering of Fundamental Particles and Necessary Relativistic Modification in Particle Behavior.
- Analyze the Similarities between Classical and Quantum Mechanics.

Learning Outcomes

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

- Develop the Model a given Problem such as Particle in a Box, Hydrogen Atom, Hydrogen Atom in Electric Fields.
- Evaluate different Quantum Systems in Atomic and Nuclear Physics.

UNIT – I SCHRÖDINGER EQUATION AND GENERAL FORMULATION **14 Hour**

Schrödinger Equation – Physical Meaning and Conditions on the Wave Function – Expectation Values and Ehrenfest's Theorem – Hermitian Operators and their Properties – Commutator Relations - Uncertainty Relation - Bra and Ket Vectors - Hilbert Space – Schrödinger, Heisenberg and Interaction Pictures. Linear Vector Space- Linear Operator- Eigen Functions and Eigen Values- Postulates of Quantum Mechanics- Simultaneous Measurability of Observables - Dirac's Notation- Equations of Motion; Schrodinger, Heisenberg and Dirac Representation- Momentum Representation.

UNIT – II QUANTUM MECHANICS IN THREE DIMENSION **12 Hour**

Schrodinger Equation in Spherical Co-Ordination- Separation of Variable-Angular Equation- Hydrogen Atom- Radial Wave equation- Spectrum of Hydrogen.

UNIT - III ANGULAR MOMENTUM **13 Hour**

The Angular Momentum Operator – Eigenvalues and Eigen Functions of L_2 – The Commutation Relations – Angular Momentum and Rotations – Ladder Operators – the Constants C+ and C- Angular Momentum Matrices Corresponding to j = ½ and j = ½ - Pauli Spin Matrices – Pauli Wave Function and Pauli Equation – Addition of Angular Momenta – Clebsh – Gordan Coefficients – concept of Isospin.

UNIT – IV APPROXIMATION METHODS **13 Hour**

Time Independent Perturbation Theory: Non-Degenerate and Degenerate Perturbation Theories -Stark Effect – WKB Approximation- Application to Tunneling Problem and Quantization Rules. Time Dependent Perturbation Theory: Harmonic Perturbation - Transition Probability.

UNIT – V RELATIVISTIC WAVE EQUATIONS **13 Hour**

The Klein – Gordan Equation – Dirac Equation – Dirac's a and b Matrices – Continuity Equation – Free Particle Solutions– Hole Theory – Spin of the Dirac Electron – Magnetic Dipole Moment of the Electron – Velocity Operator – Expectation Value of the Velocity – Relativistic Invariance of Dirac Equation.

Text Books

- Griffths. (2005). *Quantum Mechanics.* Dorling Kindersley India (Pvt). (2nd Ed.). New Delhi.
- Ghatak and Lokanathan, S. (2005). *Quantum Mechanics*. Macmillam India Ltd. New Delhi.
- Devanathan, V. (2006). *Quantum Mechanics*. Narosa Publishing House. New Delhi.

Reference Book

- Ajoy Ghatak, Lokanathan, S. (2013). *Quantum Mechanics*. Macmillan Publishers India Ltd. (5th Ed.).

SOLID STATE PHYSICS -I

PPHM207

Semester : II **Credit : 3**
Category : Core IX **Hour/Week : 5**
Class and Major: I M.Sc., Physics **Total Hour : 65**

Objectives:

To enable the students

- Understanding of the Structural aspects and Physical Properties of Condensed Matter.
- Describe basic Experimental Measurements, to show typical Data Sets and to Compare these with Theory.
- Evaluate about Nature of the Materials.

Learning Outcomes

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

- Able to Differentiate Crystal Structure and its Properties based on the Insulators, Conductors and Semiconductors.
- Analyze the concepts of Fermi Surface in different Materials.

UNIT- I CRYSTAL STRUCTURE **13 Hour**

Crystal Classes and Symmetry – 2D, 3D Lattices - Ewald's Sphere Construction – Bragg's Law – Systematic Absences – Atomic Scattering Factor – Diffraction – Structure Factor – Experimental Techniques – Laue, Powder, Rotation Methods – Phase Problem – Electron Density Distribution (Elementary Ideas Only).

UNIT -II LATTICE VIBRATION AND THERMAL PROPERTIES **13 Hour**

Dynamics of a Chain of Identical Atoms - Dynamics of a Diatomic Linear Chain Anharmonicity and Thermal Expansion-Thermal Conductivity-Phonon-Phonon Interaction-Normal and Umklapp Processes Heat Capacity-Density of Phonon States-Dulong Pities' Law – Einstein Specific Heat- Debye's Model of Specific Heat.

UNIT - III ELECTRON THEORY OF METALS **13 Hour**

Electron Moving in a One - Dimensional Well - Density of States in Three Dimension - Fermi-Dirac Statistics - Effect of Temperature on Fermi Distribution Function - Electronic Heat Capacity-Electrical Resistivity - Ohm's Law-Widemann - Franz Law-Hall Effect.

UNIT- IV FREE ELECTRON THEORY **13 Hour**

Bloch's Theorem-Kronig - Penney Model-Construction of Brillouin Zones-Extended, Reduced and Periodic Zone Schemes - Effective Mass of an Electron-Nearly Free Electron Model-Conductors, Semiconductors and Insulator.

UNIT- V FERMI SURFACE **13 Hour**

Fermi Surface and Brilloiun Zones - Harrison's Method of Constructing Fermi Surface in 2D Electron, Hole and Open Orbits - Characteristics of Fermi Surface - Effects of Electric Field on the Fermi Surface - Effect of Magnetic Field on the Fermi Surface - Quantization of Electron Orbits-Experimental Study of Fermi Surface.

Text Books

- Wahab, M.A. (2005). *Solid State Physics, Structure and Properties of Materials*. (2nd Ed.). Narosa Publishing House.
- Puri, R.K. and Babbar, V.K. (2005). *Solid State Physics*. S. Chand and Company Ltd. (3rd Ed.).
- Palanisamy, P.K. (2003). *Solid State Physics*. Scitech Publications Ltd. India.

Reference Books

- Kittel, C. (2008). *Introduction to Solid State Physics.* Wiley Eastern Ltd. (7th Ed.).
- Ajay Kumar Saxena. (2006). *Solid State Physics.* MacMillan Publishers.

ELECTROMAGNETIC THEORY

PPHM208

Semester : I **Credit : 3**
Category : Core IV **Hour/Weeks : 5**
Class & Major : I M.Sc., Physics **Total Hour : 65**

Objectives:

To enable the students

- Understand the Law and their Applications Associated with Electrostatics and Magneto Statics.
- Explain the Laws Associated with Electromagnetic and its Applications.
- Compare the Production of Electromagnetic Waves and its Propagation in Different Media.

Learning Outcomes

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

- Apply Electrostatic Concepts in Plasma Physics.
- Analyze various Laws in Electricity and Magnetism.

UNIT – I ELECTROSTATICS **13 Hour**

Coloumb's Law- Electric Field- Continuous Charge Distribution- Gauss Law and its Application –Electric Potential-Poisson & Laplace Equations- Boundary Value Problems- Dielectrics-Polarization and Displacement Vectors-Boundary Conditions-Dielectric Sphere in a Uniform Field-Molecular Polarisability and Electric Susceptibility.

UNIT – II MAGNETOSTATICS **12 Hour**

Biot-Savart's Law-Divergence and Curl of Magnetic Induction-Magnetic Vector Potential-Ampere's Circuital Law-Ampere's Law in Magnetized Materials-Effect of Magnetic Field in Atomic Orbits –Magnetic Field Inside Matter-Linear and Nonlinear Media-Magnetic Susceptibility and Permeability.

UNIT – III ELECTRODYNAMICS **14 Hour**

Electromotive Force-Ohms Law- Faradays Law-Electromagnetic Induction- Maxwell's Equations in Free Space and Linear Isotropic Media- -Magnetic Charge-Maxwell Equations in Matter-Boundary Conditions- Conservation Laws – Conservation of Energy – Poynting's Theorem - Conservation of Momentum-Scalar and Vector Potentials- Gauge Invariance-Dynamics of Charged Particles in Static and Uniform Electromagnetic Fields.

UNIT – IV WAVE PROPAGATION **13 Hour**

Electromagnetic Waves in Free Space- Reflection and Refraction, Fresnel's Law, Interference, Coherence, and Diffraction Non-Conducting Medium-Conducting Medium-Skin Depth-Reflection and Transmission at Dielectric Boundaries-Polarization-Guided Waves-Wave Guides-Propagation of Waves in a Rectangular Wave Guide-Inhomogeneous Wave Equation and Retarded Potentials-Radiation- from Moving Charges and Dipoles and Retarded Potentials.

UNIT – V APPLICATIONS – PLASMA PHYSICS **13 Hour**

Plasma – Plasma Criteria – Plasma Oscillations-Plasma Behavior in a Magnetic Field-Dispersion Relations in Plasma. Debye Shielding Problem- Plasma Confinement in a Magnetic Field-Pinch Effect- Magneto Hydrodynamic Waves- Alfven Waves.

Text Books

- David J. Griffiths. (1995). *Introduction to Electrodynamics*. Prentice Hall of India. New Delhi.
- Laud, B.B. (2005). *Electromagnetics*. New Age International Pvt. Ltd. New Delhi.
- Chopra and Agarwal. (2005). *Electromagnetic Theory*. Kadernath and Ramnath & Co. Meerut.
- Sathya Prakash. (2007). *Electromagnetic Theory and Electrodynamics*. Kadernath Ramnath & Co. Meerut.

Reference Books

- Jackson, J.D. (1998). *Classical Electrodynamics.* Wiley Eastern.
- Balmain, K.G. (1995). *Electromagnetic Waves and Radiating System*. Prentice Hall of India.
- Edward C. Jordan, Keith G. Balmain. (2001). *Electromagnetic Waves and Radiating System*. (2nd Ed.). Prentice Hall of India. New Delhi.

ELECTRONICS PRACTICAL
PPHR203

Semester : II **Credit : 3**
Category : Core X **Hour/Week : 5**
Class & Major : I M.Sc., Physics

Objectives:
To enable the students

- Gain Knowledge on the Applications of Operational Amplifier such as Differentiator, Integrator, Astable Multivibrator and Monostable Multivibrator.
- Understand the Techniques of Handling Equipment's

Learning Outcomes
On completion of the course, the students will be able to

- Effectively Engage in Electronics Experiments using PN Junction Diode, Zener Diode, Transistor and Integrated Circuits and Execute Computer Programs in Physical Science Problems.
- Design and Practice related Experiments and Acquire Data in order to Explore Electronic Principles, Effectively Communicate Results, and Critically Evaluate related Scientific Studies.

1. Design and Study of Wein Bridge Oscillator (Op-amp).
2. Study the Function of Decoder and Encoder.
3. OP-Amp Addition and Subtraction.
4. Op-Amp Inverting and Non-Inverting.
5. IC 555 Timer Astable Multivibrator.
6. IC 555 Timer Monostable Multivibrator.
7. Digital Comparator using NAND and EX-OR Gate.
8. Bridge Rectifier.
9. BCD to Seven Segment Display using 7447.
10. Study of Counter using IC 7490.

Text Book

- Mittal, A.K. (2016). *Electronics Practical*. Computech Publications. (1st Ed.). India.
- Balasubramanian, S. Ranganathan, R. Srinivasan, M.N. (2019). *A Text Book of Practical Physics*. Sultan Chand and Sons. New Delhi.

Reference Book

- Gupta, S.L. and Kumar, V. (2017). *Practical Physics*. Pragathi Prakashan. (24th Ed.). New Delhi.

E – Resources

- https://www.niser.ac.in/sps/sites/default/files/basic_page/P242_Basic_Electronics_Lab.pdf
- https://gnindia.dronacharya.info/ECE/Downloads/Labmanuals/IC_Lab_Manual.pdf

ENERGY AUDIT

PHYX201

Semester : II **Credit : 1**
Category : PG Service Learning **Total Hour : 40**
Class & Major: M. Sc Physics

Objectives:
To enable the students

- Understand about the Energy audit and its Measurements.
- Acquire the Knowledge about the Practical Auditing Methodology.
- Interpret the Power Optimization.

INTRODUCTION TO ELECTRICAL POWER AND ELECTRICITY

Electrical Parameters - Definitions - Resistive, Inductive, Capacitive Loads - Active Power - Reactive Power - Apparent Power - Power Factor - Linear and Non-Linear Loads – Electricity Demand (kVA/kW) Calculation - Electricity Tariff.

ELECTRICAL DISTRIBUTION SYSTEM

HT Supply – Control - Distribution Transformer - Power Control Centre (PCC) Captive Generator - Power Cables - Motors - LT Power Capacitors - Lighting – UPS - Servo Stabilizer - Electrical Measuring Instruments - Importance of Measurements - Types of Meters - Instantaneous Measuring Meter.

Activity

Purpose: To Gain the Basic Knowledge and Understanding about Audit the Energy for Electrical Consumption.

1. To Study and Analyze the Power Utilization for the given Building Area/Room.
2. To Measure and Calculate the Voltage/Current of an Available Electrical System (Lights and Fans) and Equipments.
3. To Analyze the Power Utilization and Make the Strategy for Power Consumption in the Electrical Items.
4. To Submit the Detailed Report with the Conclusion Made during the Audit.

Text Books

- Muthuvelan, M. Balasubramanian, H. (2012). *A Practical Guide to Reactive Power Management in Industry*. SITRA Publication. Coimbatore.
- Wayne, C. Turner. (1997). *Energy Management Handbook*. The Fairmount Press. Inc.

Reference Books

- Francisco, C.DE LA ROSA. (2010). *Harmonics and Power Systems*. Indian Edition. CRC Press.
- Ramasamy, Natarajan. (2010). *Power System Capacitors*. Indian Edition, CRC Press.

NANOSCIENCE

PPHE201

Semester : II **Credit : 4**
Category : Non-Major Elective **Hour/Weeks : 5**
Class & Major: I PG **Total Hour : 65**

Objectives

To enable the students

- Introduce the Developing Field of Nanoscience and Technology.
- Special Focus on the Methods of Synthesis, Characterization Techniques and Applications.

Learning Outcomes

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

- Synthesize Nanoparticles by different Chemical Routs and Characterize them in the Laboratory.
- Characterization of Nanostructured Materials using X-Ray Diffraction, Electron Microscopy, Atomic Force Microscopy and Scanning Tunneling Microscopy.

UNIT – I FUNDAMENTALS OF NANOSCALE SCIENCE **13 Hour**

Introduction-Nano and Nature-Background to Nanotechnology-Scientific Revolutions Opportunities at the Nanoscale-Time and Length Scale in Structures-Energy Landscapes Basic Intermolecular Forces Inter Dynamic Aspects of Intermolecular Forces.

UNIT – II CLASSIFICATION OF NANOPARTICLES AND ITS PROPERTIES **14 Hour**

Metal Nanoparticles: Size Control of Metal Nanoparticles, Structural, Surface, Electronic and Optical Properties. Semiconductor Nanoparticles: Solid State Phase Transformation, Excitons, Quantum Confinement Effect, Semiconductor Quantum Dots (SQDs), Correlation of Properties with Size, Quantum Well, Quantum Wires, Supper Lattices Band and Band Offsets, Quantum Dot Lasers.

UNIT – III SYNTHESIS OF NANOMATERIALS **12 Hour**

Wet Chemical Synthesis for Nanomaterials: Chemical and co-Precipitation, Sol Fundamentals-Sol-Gel Synthesis of Metal Oxides, Micro Emulsions or Reverse Micelles, Solvothermal, Microwave Heating Synthesis, Sonochemical Synthesis, Electrochemical Synthesis, Photochemical Synthesis, Langmuir Blodgett (LB) Technique.

UNIT - IV CHARACTERIZATION TECHNIQUES **13 Hour**

Powder X-Ray Diffraction, Energy Dispersive X-Ray (EDX), X-Ray Photoelectron Spectroscopy (XPS), Scanning Electron Microscope (SEM), Transmission Electron Microscope (TEM), Scanning Tunneling Microscope (STM), Atomic Force Microscope (AFM), UV-Visible Absorption.

UNIT – V APPLICATIONS OF NANOMATERIALS AND NANOCOMPOSITES **13 Hour**

Nanosensors Based on Optical Properties and Quantum Size Effects: Sensors Based on Physical Properties-Electrochemical Sensors, Sensors for Aerospace, Defense and Biosensors. Energy: Solar Cells, LEDs and Photovoltaic Device Applications.

Text Books

- Viswanathan, B. (2006). *Structure and Properties of Solid State Materials.* Oxford: Alpha Science International (2nd Ed.).
- Pradeep, T. (2007). *Nano the Essentials*. Tata McGraw-Hill Publishing Company Ltd.

Reference Books

- Schmidt, G. (2004). *Nanoparticles: from Theory to Application.* Wiley Weinheim.
- Sulabha, K. Kulkarni. (2007). *Nanotechnology Principle and Practices*. Capital Publishing Company. India.

III & IV EVALUATION COMPONENTS OF CIA

Semester	Category	Course Code	Course Title	Component-III	Component-IV
I	Core I	PPHM101	Mathematical Physics- I	Seminar - Power Point Presentation	Problem solving
	Core II	PPHM107	Classical Mechanics	Assignment	Assignment
	Core III	PPHM105	Electronics	Poster Presentation	Simple experiments (Model display)
	Core IV	PPHM106	Molecular Spectroscopy	Poster Presentation	Model display
II	Core VI	PPHM205	Mathematical Physics II	Problem solving	Assignment
	Core VII	PPHM201	Quantum Mechanics I	Assignment	PPT
	Core VIII	PPHM208	Electromagnetic Theory	Assignment	Poster presentation
	Core IX	PPHM207	Solid State Physics I	Assignment	Seminar

NON-MAJOR ELECTIVE

Semester	Category	Course Code	Course Title	Component-III	Component-IV
II	NME	PPHE201	Nanoscience	Seminar	Poster Presentation