PG & RESEARCH DEPARTMENT OF PHYSICS

HOLY CROSS COLLEGE (AUTONOMOUS)

Affiliated to Bharathidasan University
Nationally Accredited (4ᵗʰcycle) with (A⁺⁺) Grade (CGPA 3.75/4) by NAAC
College with Potential for Excellence
Tiruchirappalli-620002.

SCHOOL OF PHYSICAL SCIENCES
PG & RESEARCH DEPARTMENT OF PHYSICS

Programme: B. Sc. PHYSICS/ PHYSICS WITH SPECIALIZATION IN ELECTRONICS CHOICE BASED CREDIT SYSTEM

PO No.	Programme Outcomes
	Upon completion of the B.Sc. Degree Programme, the graduate will be able to
PO-1	Promote Analytical Thinking and research skills in the minds of students
PO-2	Strive for consistent academic excellence and integrated personality development
PO-3	appreciate and apply Basic Physics principles in everyday life
PO-4	Acquire practical skills to gather information, assess, create and execute new ideas to develop entrepreneurial skills
PO-5	Mould the students to face the multi-faceted world of IT, with physics as the base and engulfing electronics
PO-6	Apply knowledge and skill in the design and development of Electronics circuits to cater to the needs of Electronic Industry

PSO No.	Programme Specific Outcomes
	Upon completion of these courses the student would
PSO-1	Acquire academic excellence with an aptitude for higher studies and research
PSO-2	Provide knowledge about material properties and its application for developing technology to ease the problems related to the society
PSO-3	Analyze the applications of mathematics to the problems in physics
PSO-4	Learn to design an experiment (or series of experiments) demonstrating their understanding of the scientific method and processes
PSO-5	Develop communication skills in communicating physics-related topics
PSO-6	Apply appropriate techniques and modern tools to complex scientific activities

HOLY CROSS COLLEGE (AUTONOMOUS), TIRUCHIRAPPALLI - 620 002
SCHOOL OF PHYSICAL SCIENCES

PG & RESEARCH DEPARTMENT OF PHYSICS
B.Sc PHYSICS

COURSE STRUCTURE (I & II SEMESTER) - CBCS

(For the candidates admitted from June 2020 onwards)

Sem	Part	Course	Title of the Course	Code	Hrs/Wk	Credits	Marks
I	I	Language - 1	Tamil Paper I/ Hindi Paper I/ French Paper I	U20TL1TAM01/ U20HN1HIN01/ U20FR1FRE01	3	3	100
	II	English - 1	English Paper -I	U20EL1GEN01	3	3	100
	III	Major Core - 1	Properties of Matter and Mechanics	U20PH1MCT01	6	5	100
		Major Core - 2	Linear and Non-linear Optics	U20PH1MCT02	4	3	100
		Major Core - 3	Practical I: General Physics Practicals	U20PH1MCP03	3	-	-
		Allied - 1	Mathematics I - Algebra, Calculus, Trigonometry	U20MA1ALT01	4	2	100
		Allied - 2	Mathematics II- Analytical Geometry of Three Dimensions and Vector Calculus	U20MA1ALT06	4	2	100
	IV	Environmental Studies	Environmental Studies	U20RE1EST01	2	1	100
		Value Education	Ethics/Bible studies/Catechism	U20VE2LVE01/ U20VE2LVB01/ U20VE2LVC01	1	--	--
		Service Oriented Course			--	--	--
		Internship/ Field Work/ Field Project 30 Hours - Extra Credit		U20SP1ECC01		2 (Extra Credit)	100
TOTAL					**30**	**19+2**	**700+100**

	I	Language - 2	Tamil Paper II/ Hindi Paper II/ French Paper II	U20TL2TAM02/ U20HN2HIN02 U20FR2FRE02	3	3	100
	II	English – 2	English paper -II	U20EL2GEN02	3	3	100
II	III	Major Core – 4	Heat, Thermodynamics and Statistical Mechanics	U20PH1MCT04	6	5	100
		Major Core – 3	Practical I: General Physics Practicals	U20PH1MCP03	3	4	100
		Allied - 3	Mathematics III - Laplace Transform, Partial Differential Equations and Fourier Series	U20MA2ALT08	4	2	100
		Major Elective -1	Within School		5	3	100
	IV	Skill Based Course (SBC)- 1	Soft skill development	U20RE2SBT01	2	1	100
		Skill Based Course (SBC)- 2	Rural Enrichment and Sustainability Development	U20RE2SBT02	2	1	100
		Industrial Relations	Photovoltaic Systems	U20PH2IRT01	1	1	100
		Value Education	Ethics/Bible studies/Catechism	U20VE2LVE01/ U20VE2LVB01/ U20VE2LVC01	1	1	100
		Service Oriented Course			--	--	
		Internship / Field Work /Field Project 30 Hours -Extra Credit		U20SP2ECC02	--	2 (Extra Credit)	100
		TOTAL			30	24+2	1000+100

1134

List of Allied courses offered

Sem	Part	Course	Title of the Course	Code	Hrs/Wk	Credits	Marks
I	III	Allied Physics Paper :1	Properties of Matter, Optics and Sound	U20PH1ALT01	4	2	100
	III	Allied Physics Paper : 2	Basic Physics Practicals	U20PH1ALT02	4	2	100
II	III	Allied Physics Paper : 3	Modern Physics, Electricity and Electronics	U20PH2ALT04	4	2	100

HOLY CROSS COLLEGE (AUTONOMOUS)
TIRUCHIRAPPALLI- 620 002

SCHOOL OF PHYSICAL SCIENCES

PG & RESEARCH DEPARTMENT OF PHYSICS
CHOICE BASED CREDIT SYSTEM

B.Sc. PHYSICS

First Year - Semester – I

Course Title	MAJOR CORE 1: PROPERTIES OF MATTER AND MECHANICS
Total Hours	90
Hours/Week	6 Hrs /Wk
Code	U20PH1MCT01
Course Type	Theory
Credits	5
Marks	100

General Objective: To study the basic principle and concepts of gravitation, properties of matter, rigid body dynamics.

Course Objectives:

   The Learner will be able to:

CO No.	Course Objectives
CO-1	Understand the basic ideas of Gravitation on the basis of Kepler law and properties of matter
CO-2	Understand the mechanics of rigid bodies and apply it to solve problems in rigid body dynamics
CO-3	Understand the concept of surface tension and viscosity with different measuring experiments
CO-4	Understand simple harmonic oscillator and apply it to solve problems in mechanics and understand the basics of wave motion
CO-5	Study the concepts of general and special theory of relativity and understand the idea of space, mass and time on the basis of Einstein's concepts

UNIT I   **GRAVITATION AND ELASTICITY**   **(15 Hrs)**

Newton's law of gravitation, Motion of a particle in a central force field – Kepler's law (statements only) –Satellite in circular orbit and applications.

Hooke's law–Different moduli of elasticity–Young's modulus (E)–Rigidity modulus(G)–Bulk modulus(K)–Poisson's ratio–work done in linear, shearing and volume strain –Relation connecting elastic constants and Poisson's ratio–Bending of beams–Bending couple–Cantilever depression and oscillation–Measurement of Young's modulus by non–uniform bending, uniform bending and cantilever depression.

Extra reading / Key words: *Gravitational constant, Gravitational field and gravitational potential*

UNIT II   **DYNAMICS OF RIGID BODIES**   **(15 Hrs)**

Moment of inertia - Radius of gyration - Theorems of M .I - M.I of circular disc, solid cylinder, hollow cylinder - K.E of a rotating body – M.I of a diatomic molecule – Rotational energy state of a rigid diatomic molecule – centre of mass-conservation laws- conservation forces and energy- negative gradient of potential energy- laws of conservation of momentum –angular momentum- conservation of angular momentum.

Extra reading / Key words: *Compound pendulum, Simple pendulum*

UNIT III   **SURFACE TENSIONAND VISCOSITY**   **(15 Hrs)**

Surface tension–Angle of contact–Pressure difference across a liquid surface– –Experimental determination of surface tension–Jaeger's method–Quincke's method–Drop weight method– Capillary rise method.

Viscosity- coefficient of viscosity—streamline flow of turbulent flow- critical velocity - Poiseuille's formula for the flow of liquid through a capillary tube- corrections to Poiseuille's formula- Poiseuille's method for determining co-efficient of viscosity of a liquid-Bernoulli theorem-venturimeter - filter pump- the atomizer.

Extra reading / Key words: *Flow of liquid, Neumann's triangle, Rankine's method*

UNIT IV   WAVES AND OSCILLATIONS   (15 Hrs)

Simple harmonic motion - Periodic and simple harmonic motions – Average values of kinetic and potential energies of a harmonic oscillator - Superposition of two or more Simple Harmonic Oscillators - Differential Equation for Simple Harmonic Oscillator and its General Solution – Damped and Forced Oscillators – Resonance – Wave motion – characteristics of wave motion- Transverse wave motion- Longitudinal wave motion-Equation of simple harmonic wave- Differential equation of wave motion-particle velocity- wave velocity.

Extra reading / **Key words:** *Coherent state, Displacement operator*

UNIT V   SPECIAL THEORY OF RELATIVITY   (15 Hrs)

Galilean – Newtonian relativity, Galilean transformations – Michelson Morley experiment and its importance – Einstein's postulates – Lorentz transformations and its interpretation – consequence of Lorentz transformation – Length contraction, time dilation – relativistic addition of velocities – Mass energy equivalence – Basic ideas of general theory of relativity.

Extra reading / Key words: *Einstein, Speed of light*

Course Outcomes:

The Learner will be able to:

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Recall ,relate and measure the Elasticity and elastic moduli	PSO 1	R, U
CO-2	Define and Discuss the dynamics of rigid bodies and conservation laws and applying the dynamics on various systems	PSO 5	R,U
CO-3	Discuss the theory and obtain the experimental results of surface tension and viscosity using different methods	PSO 2	U, Ap
CO-4	Discuss and derive simple harmonic motion, damped and forced oscillation	PSO 3	U
CO-5	Explain the concepts of and travelling and standing wave systems in one dimension	PSO 2	U
CO-6	Introduce and Derive Lorentz transformation equations and state the postulates of Einstein's special theory of relativity	PSO 5	R,U,
CO-7	Gain Employability-Knowledge and Problem solving skills	PSO 6	Ap

BOOKS FOR STUDY

1. Mathur D.S, P S Hemne, Mechanics, S. Chand & Co., (2014).
2. Brijlal and N. Subramaniam, Properties of Matter. S. Chand & Co, New Delhi (1994).
3. R. Murugeshan, Properties of Matter, S. Chand & Company Ltd, New Delhi (2016).
4. N.Subrahmanyam Brij Lal, Waves and Oscillations, Vikas Publishing House PVP Ltd., New Delhi (2006).

BOOKS FOR REFERENCE

1. R.N. Chaudrey, Waves and Oscillations, New Age International Publishers (2010).
2. D. Halliday, R. Resnick and J. Walker, Fundamentals of Physics, Wiley, NY, 6th edition (2000).

SCHOOL OF PHYSICAL SCIENCES

PG & RESEARCH DEPARTMENT OF PHYSICS
CHOICE BASED CREDIT SYSTEM

B.Sc. PHYSICS

First Year - Semester – I

Course Title	MAJOR CORE 2: LINEAR AND NON - LINEAR OPTICS
Total Hours	60
Hours/Week	4 Hrs /Wk
Code	U20PH1MCT02
Course Type	Theory
Credits	3
Marks	100

General Objective: To understand the concepts of aberrations in lens, interference of light, diffraction, polarization, laser and basics of nonlinear optics.

Course Objectives (CO): The Learner will be able to:

CO No.	Course Objectives
CO-1	remember the phenomenon of reflection and refraction, the lens system, aberration and understand the methods of minimizing spherical and chromatic aberrations, Ramsden's and Huygen's eyepieces
CO-2	apply the concept of interference to determine the thickness of the wire and test the planes of a surface wavelength of sodium and monochromatic light
CO-3	understand the term diffraction, normal incidence, dispersive power of grating . understand the concepts Optical activity, Rotatory Polarisation and determine the specific rotator power of sugar solution using Laurent's half shade polarimeter
CO-4	remember the basic principles of lasers and understand the various types of laser
CO-5	understand the fundamentals of Non linear optics and basics of harmonic generation

UNIT I   LENSES AND ABERRATIONS   (12 Hrs)

 Lens System - Aberration in lenses - Spherical aberration in a lens -methods of minimizing spherical aberration - Chromatic aberration in lens– Condition for achromatism for two thin lenses in contact and separated by a distance- - Huygen's and Ramsden's eyepieces - Comparison of Huygen's and Ramsden's eyepieces.

Extra reading / Key words: *simple experiment using lens, Laser tuning,Optical coherence*

tomography systems

UNIT II   INTERFERENCE   (12 Hrs)

 Introduction - Theory of Interference fringes -Wedge shaped films - Air wedge - determination of diameter of a thin wire - Testing the planeness of a surface-Newton's rings – theory and experiment-Experimental determination of refractive index of liquid. - Michelson's Interferometer - Determination of wavelength of monochromatic light and difference in wavelength between neighbouring lines.

Extra reading / Key words: *Flatness testing, Fabry- Perot Interferometer*

.
UNIT III   DIFFRACTION AND POLARISATION   (12 Hrs)

 Diffraction -Fresnel diffraction and Fraunhofer diffraction – grating – Normal incidence
– Dispersive power of a grating - Resolving power of a grating

 Optical activity- Rotatory Polarisation – Fresnel's theory of optical rotation – Specific rotation – Biot's law for Laurent's half shade polarimeter – Determination of specific rotatory power of sugar solution.

Extra reading / Key words: *DVD*, *Liquid crystal display, Polaroid filter*

UNIT IV   LASERS   (12 Hrs)

 Absorption and Emission - Spontaneous emission - Stimulated emission – Einstein coefficients -Basic principles of lasers-population inversion-pumpingTypes

of laser-Solid state lasers- Ruby- Nd YAG laser- Gas lasers- He-Ne lasers-
Semiconductors lasers- Diode laser- p-n junction laser.

Extra reading / Key words: *Photons, Excitation*

UNIT V INTRODUCTION TO NON LINEAR OPTICS (12 Hrs)

Linear and nonlinear – Nonlinear optics –Wave propagation in an anisotropic
crystal- Polarization response of materials to light- Harmonic generation-Second
harmonic generation- Sum and difference frequency generation-Phase matching-
Third harmonic generation- bistability- Self focusing.

Extra reading / Key words: *Non linear optical processes, Non linear fiber optics*

**Note: Texts given in the Extra reading / Key words must be tested only through
assignment and seminars.**

Course Outcomes:

The Learner will be able to:

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Discuss the phenomenon of reflection and refraction, aberration, spherical and chromatic aberrations, Ramsden's and Huygen's eyepieces	PSO 1	U
CO-2	Explain the phenomenon of diffraction and to determine the thickness the wire and test the planes of a surface wavelength of sodium and monochromatic light	PSO 4	U, Ap
CO-3	Describe diffraction, normal incidence, dispersive power of grating, resolving power of grating	PSO 4	U, Ap
CO-4	Recall polarization and determine the specific rotatory power of sugar solution using Laurent's half shade polarimeter	PSO 4	R, Ap
CO-5	Recall the basic principles of laser and explain the working of types of lasers.	PSO 4	U
CO-6	Explain the basics of non linear optics and Differentiate the Linear and non linear optics	PSO 6	U

**PSO – Programme Specific Outcomes; CO – Course Outcome; R- Remember; U- Understand;
Ap – Apply An – Analyse; E- Evaluate; C – Create**

BOOKS FOR STUDY

1. Murugeshan,R and Kiruthiga Sivaprasath, Optics and Spectroscopy, S.Chand and Company, Ltd. (2010).
2. B.B Laud, Lasers and Nonlinear Optics, New Age international (P) Ltd. New Delhi, 2nd Edition (1991).

BOOKS FOR REFERENCE

1. Subramaniyam N, Brijlal and Avadhanulu. M.N, A Text Book of Optics, S.Chand and Company, Ltd (2007).
2. Murugeshan, R Optics and Spectroscopy S.Chand and Company, Ltd. (1997).
3. Robert W. Boyd, Nonlinear Optics, 2nd Edn, Academic Press, New York (2003).

SCHOOL OF PHYSICAL SCIENCES

PG & RESEARCH DEPARTMENT OF PHYSICS
CHOICE BASED CREDIT SYSTEM

B.Sc. PHYSICS

First Year - Semester – I

Course Title	MAJOR CORE 3: PRACTICAL I - GENERAL PHYSICS PRACTICALS
Total Hours	45
Hours/Week	3 Hrs /Wk
Code	U20PH1MCP03
Course Type	Practical
Credits	3
Marks	100

General Objective: To apply the basic principles of properties of matter, Electricity, Electronics and Optics by doing the relevant experiments.

Course Objectives:

The Learner will be able to:

CO No.	Course Objectives
CO-1	understand and evaluate the Young's modulus and Rigidity modulus of the given material
CO-2	analyze the electrical parameters like resistance using potentiometer and understand the basic concept of thermal physics by calculating the temperature coefficient of thermistor using P.O box
CO-3	understand and analyze the characteristics of junction diode and the functions of logic gates using discrete components
CO-4	apply the basic principles of optics to determine the thickness of a wire by using Air wedge Method, radius of curvature of the lens by forming Newton's rings, the refractive index of a material of a prism and for the given liquid using spectrometer

CO-5	understand and apply the concept of properties of matter to determine the coefficient of viscosity and surface tension by doing simple experiments like burette method, constant pressure head, drop weight method and capillary rise method
CO-6	understand the various properties like radius of curvature and refractive index of convex, concave lens and combination of convex and concave lenses and understand the characteristics of sound by fall plate method.

Any Fourteen Experiments Only

1. Determination of Young's modulus by non-uniform bending - Microscope
2. Determination of Young's modulus by uniform bending - Telescope
3. Determination of Young's modulus by Cantilever method - Microscope
4. Determination of Rigidity modulus of a rod by Static Torsion method
5. Measurement of Resistance using Potentiometer
6. Determination of Refractive Index of material of a prism using Spectrometer
7. Study of the characteristics of a Junction Diode
8. Study of Logic gates using discrete components – AND, OR & NOT
9. Determination of thickness of a wire by forming Air Wedge
10. Determination of Refractive Index of the given liquid using Spectrometer
11. Determination of co-efficient of viscosity of liquid by burette method
12. Determination of the surface tension of a liquid by drop weight method
13. Determination of temperature coefficient of thermistor using P.O Box
14. Determination of refractive index of material by forming Newton's rings.
15. Determination of focal length, radius of curvature and refractive index of convex, concave lens and combination of convex and concave lenses.
16. Determination of co-efficient of viscosity of liquid by constant pressure head.
17. Comparison of co-efficient of viscosity of liquid by Oswald.
18. Determination of the surface tension of a liquid by capillary rise method.
19. Determination of frequency of a tuning fork by fall plate method.
20. Determination of viscocity of air by Rankine's method.

(For Candidates admitted from the academic year 2020-21 onwards) HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI- 620 002

SCHOOL OF PHYSICAL SCIENCES

PG & RESEARCH DEPARTMENT OF PHYSICS
CHOICE BASED CREDIT SYSTEM

B.Sc. MATHEMATICS

First Year - Semester – I

Course Title	ALLIED PHYSICS PAPER 1: PROPERTIES OF MATTER, OPTICS AND SOUND
Total Hours	60
Hours/Week	4 Hrs /Wk
Code	U20PH1ALT01
Course Type	Theory
Credits	2
Marks	100

General objective: To understand the properties of matter and appreciate how the relevant theories find application in various devices, the modes of transfer of heat and the methods of achieving low temperature and to understand the nature of simple harmonic motion, sound and the basic principles of optics.

Course Objectives:

The Learner will be able to:

CO No.	Course Objectives
CO-1	understand, Bernoulli's theorem, Poiseuille's formula and remember laws of diffusion and understand osmotic pressure.
CO-2	understand conduction, convection and radiation in thermal physics.
CO-3	understand the basic concepts of stress, strain, internal force and equilibrium in solids.
CO-4	understand the principle and behavior of Light from optics.

CO-5	understand the nature of simple harmonic motion and its applications and understand the importance of sound parameters.

UNIT I **VISCOSITY, DIFFUSION AND OSMOSIS** (12 Hrs)

Bernoulli's theorem -venturimeter - viscosity- coefficient of viscosity- Streamlined motion and turbulent motion - Poisuelle's formula- experiment to determine viscosity by burette method and Stoke's method - Diffusion- Graham's laws of diffusion- Fick's law-coefficient of diffusion - determination of coefficient of diffusion- Osmosis- Osmotic pressure- experimental determination of osmotic pressure -Laws of osmotic pressure.

Extra reading / Key words: *Molasses, Lubricants, Turgor pressure, Dialysis*

UNIT II **THERMAL PHYSICS** (12 Hrs)

Newton's law of cooling- verification of Newton's law of cooling- specific heat capacity of a liquid by cooling- Bomb calorimeter- Specific heat capacities of gases-Mayer'srelation.Transmission of Heat - Co-efficient of Thermal Conductivity - applications of conduction of heat -convection -applications of convection-properties and applications of Radiations - Stefan's law - Solar constant- temperature of the sun - Porous plug experiment - JK effect - Theory - Inversion Temperature - Liquefaction of air-Linde's process.

Extra reading / Key words: *Infrared radiation, Condensation*

UNIT III **ELASTICITY** (12 Hrs)

Stress and Strain - Hooke's law - Moduli of Elasticity - Poisson's Ratio - relation between the elastic moduli-Bending of Beams - Bending Moment - Cantilever (pin and microscope) - Uniform Bending (optic lever method) - Rigidity modulus: static torsion -Torsion pendulum- Couple per unit twist-work done- I shape of Girders - Surface tension - surface energy - determination of surface tension (drop weight method).

Extra reading / Key words: *Elastomers, Fracture mechanics*

UNIT IV   OPTICS   (12 Hrs)

Refraction - Refraction through prism- Refractive index - Interference - Condition for Interference - Newton's rings - Air wedge - Diffraction - theory of grating - difference between prism and grating spectrum- Determination of wavelength of light using transmission grating(Normal incidence)- LASER principles- He-Ne Laser- Applications of laser in Medicine and Industry.

Extra reading / Key words: *Deviation, Duality, Polarization, Photon excitation*

UNIT V   SOUND   (12 Hrs)

Simple Harmonic Motion - Angular velocity - Angular acceleration - Uniform circular motion - Acceleration of a particle in a circle - centrifugal force - Centrifuge - Banking of curves- Motion of a bicycle around a circle. Characteristics of sound waves - Amplitude, pitch, frequency and loudness - Acoustics of buildings - Reverberation - Reverberation time - Sabine's formula - Condition for good acoustics - Ultrasonics – Introduction – Production- Properties- Applications.

Extra reading / Key words: *Musical note, Echo, Decibel meter*

Course Outcomes:

The Leaner will be able to :

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	State Poiseuille's formula and determine viscosity of liquids by various methods and differentiate between diffusion and osmosis.	PSO 2,6	U, Ap
CO-2	Demonstrate conduction, convection and radiation applications in thermal physics.	PSO 5	U, Ap
CO-3	Explain the basic concepts of stress, strain, internal force and equilibrium in solids and characterize materials with elastic constitute relations in elasticity.	PSO 4	U

CO-4	Recall and relate the principles of Light and describe the working and operation of He-Ne Laser	PSO 1,2	R, U
CO-5	Explain the nature of S.H.M. and its applications and the importance of sound parameters	PSO 5,2	U, Ap

PO – Programme Outcomes; CO – Course Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

BOOKS FOR STUDY

1. Murugesan R Allied Physics, New Delhi, S. Chand & Co. Ltd (2005).
2. Murugeshan R and KiruthigaSivaprasath, Properties of matter and Acoustics S. Chand & Company Ltd, New Delhi, 2ndedition (2012).
3. Brijlal and Subramaniam, Heat and Thermodynamics S. Chand & Company Ltd, New Delhi (2002).
4. Brijlal and Subramaniam, Text Book of Optics, S. Chand & Co, New Delhi (1998).
5. Murughesan, Mechanics, S.Chand & Co, New Delhi, (2006).

BOOKS FOR REFERENCE

1. Rajam J. B.andArora C.L. A Text Book of Heat and Thermodynamics, S. Chand & Co, New Delhi (1983).
2. M. Narayanamurti and N. Nagaratnam, Heat, The National Publishing Co., Madras (1987).
3. R. Murugeshan, Optics and spectroscopy, 1st edition, S.Chand, New Delhi (2003).
4. D.S.Mathur,Mechanics, S.Chand& Co., New Delhi, Revised edition 2012.

(For Candidates admitted from the academic year 2020-21 onwards) HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI- 620 002

SCHOOL OF PHYSICAL SCIENCES

PG & RESEARCH DEPARTMENT OF PHYSICS
CHOICE BASED CREDIT SYSTEM

B.Sc. MATHEMATICS

First Year - Semester – I

Course Title	ALLIED PHYSICS PAPER 2: BASIC PHYSICS PRACTICALS
Total Hours	60
Hours/Week	4 Hrs /Wk
Code	U20PH1ALP02
Course Type	Practical
Credits	2
Marks	100

General Objective: To understand and apply the principles of physics by doing related experiments in Properties of Matter, Optics, Electricity and Electronics.

Course Objectives
(CO): The Leaner will
be able to:

CO No.	Course Objectives
CO-1	understand and evaluate the Young's modulus of the given material.
CO-2	apply the basic principles of optics to determine the thickness of a wire by using Air wedge Method, to find the radius of curvature of the lens by forming Newton's rings, the dispersive power of a prism and the refractive index of different liquids.
CO-3	understand and apply the concept surface tension and viscosity by doing simple experiment like drop weight method, Poiseuille's flow method and stoke's method.
CO-4	understand and evaluate the temperature coefficient using post office box.
CO-5	understand and apply the concept of sound using decibel meter and Lissajous pattern.

CO-6	understand and analyze the characteristics of electronic devices such as ZenerJunction diodes and Transistors.
CO-7	understand, apply and analyze the concept of digital electronics by doing simple experiments using IC chips and discrete components.

Any fourteen experiments only

1. Determination of Young's modulus of the material of a bar by uniform bending (Scale and telescope)
2. Determination of Young's modulus of the material of a bar using Cantilever (Pin and Microscope).
3. Determination of the thickness of the wire by using Air wedge method.
4. Determination of the radius of curvature of the lens by forming Newton's rings.
5. Determination of dispersive power of the prism using Spectrometer.
6. Determination of refractive index of different liquids using Abbe's refractometer and calculate the velocity of light in liquid medium.
7. Determination of surface tension by drop weight method
8. Comparison of viscosities of two liquids – Burette method
9. Determination of Coefficient of viscosity of liquid by Poiseuille's flow method.
10. Determination of coefficient of viscosity of liquid by Stokes method
11. Determination of temperature coefficient of thermistor using post office box.
12. Study of Lissajous pattern using cathode ray oscilloscope.
13. Measurement of loudness of a sound using decibel meter.
14. Determination of self inductance of the coil using Anderson's bridge.
15. Study of the characteristics of transistor -Common emitter Configuration
16. Study of Junction Diode characteristics.
17. Study of Zener Diode characteristics.
18. Construction of Bridge Rectifier.
19. Study of Logic gates AND and OR using discrete components.
20. Study of IC –Chips.

(For Candidates admitted from the academic year 2020-21 onwards) HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI- 620 002

SCHOOL OF PHYSICAL SCIENCES

PG & RESEARCH DEPARTMENT OF PHYSICS
CHOICE BASED CREDIT SYSTEM

B.Sc. PHYSICS

First Year - Semester – II

Course Title	MAJOR CORE 4: HEAT, THERMODYNAMICS AND STATISTICAL PHYSICS
Total Hours	90
Hours/Week	6 Hrs /Wk
Code	U20PH2MCT04
Course Type	Theory
Credits	5
Marks	100

General Objective: To study the basic principles of Heat, Thermodynamics and statistical physics.

Course Objectives:
The Learner will be able to:

CO No.	Course Objectives
CO-1	understand the basic ideas of kinetic theory of gases
CO-2	remember the laws of thermodynamics and understand their applications
CO-3	understand the concepts of low temperature physics and apply it for practical applications.
CO-4	understand the concept of transmission of heat
CO-5	understand the concepts of statistical physics and three main distributions.

UNIT I   KINETIC THEORY OF GASES   (15 Hrs)

Introduction- concepts of ideal gas-elements of kinetic theory of gas-pressure

exerted by gas- Brownian motion-degrees of freedom-Equipartition of energy – relation between molar specific heats and degrees of freedom-specific heats of Mono, Di and polyatomic gas-Van der Waals' Equation of State- mean free path-application to atmosphere physics.

Extra reading/Key words: *Evaporation, thermionic emission*

UNIT II   THERMODYNAMICS   (15 Hrs)

Thermodynamic system-Zeroth law of thermodynamic-Thermodynamic equilibrium-Internal energy-First law of thermodynamics-Significance of the first law-Carnot's ideal heat engine – Derivation of its efficiency in terms of temperatures –Second law of thermodynamics- Internal combustion engine – Otto & Diesel Engines – Entropy – Changes in Entropy in reversible and irreversible processes – T-S Diagram – Maxwell's thermodynamic relations – T - ds relations – Clausius and Claypeyron latent heat equations using Maxwell's relations- Thermodynamic potentials.

Extra reading / Key words: *Energy, State coordinates*

UNIT III   LOW TEMPERATURE PHYSICS   (15 Hrs)

Joule-Thomson effect-porous plug experiment: liquefaction of gases-principle of regenerative cooling-Linde's process-principle of cascaded cooling- adiabatic demagnetization-practical applications of low temperatures: refrigerating machines-electroflux refrigerator-air conditioning machines-effects of $CF_2 Cl_2$ on Ozone layer.

Extra reading/Key words: *Temperature of inversion, Heat capacity*

UNIT IV   TRANSMISSION OF HEAT   (15 Hrs)

Introduction-Transmission of heat-Thermal conductivity – Rectilinear flow of heat – experimental methods to determine the coefficient of thermal conductivity – Forbes's method and Lee's disc method – Kirchoff's law, Stefan's law and Newton's law of radiation – Black body radiation – Energy distribution in the black body spectrum-Solar constant- temperature of the sun-application of convection: central heating system.

Extra reading / **Key words:** *Conduction, Heat transfer*

UNIT V   STATISTICAL PHYSICS   (15 Hrs)

Introduction-probability-principle of equal a priori probability-permutations and combinations-thermodynamic probability-microstate and macrostate-constraints on a system- Ensemble and average properties-fundamental postulates of statistical mechanics-statistical Ensembles – microcanonical, canonical and grand canonical ensembles –three kinds of particles-Basics of Maxwell-Boltzmann, Fermi-Dirac and Bose-Einstein distribution.

Extra reading/Key words:*Degenerate gases, photon gas*

Note: Texts given in the Extra reading/Key words must be tested only through assignment and seminars.

Course Outcomes:

The Learner will be able to:

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Remember the postulates of kinetic theory of ideal gases	PSO 1	R, U
CO-2	Demonstrate Carnot's ideal heat, Internal combustion engine, Otto & Diesel Engines	PSO 2	U, An
CO-3	Describe Changes in Entropy in reversible and irreversible processes	PSO 3	U
CO-4	Explain the thermal physics concepts in liquids and gases	PSO 2	U, Ap
CO-5	Compare Conduction, Convection and Radiation	PSO 5	U,E
CO-6	Compare the three statistical distribution laws	PSO 6	U,E

PO – Programme Outcomes; CO – Course Outcome; R- Remember; U- Understand; Ap – Apply; An – Analyse; E- Evaluate; C – Create

BOOKS FOR STUDY

1. Murugesan R, KiruthigaSivaprasath Properties of Matter and Acoustics, S. Chand & Co. (2012).
2. Brijlal&Subramaniam Heat Thermodynamics and Statistical Physics - S. Chand &

Co. New Edition (2012).

BOOKS FOR REFERENCE

1. F. Reif, Fundamentals of Statistical and Thermal Physics, McGraw-Hill (1988).
2. Rajam J.B., (Revised by Arora. G.I.,) A Text book of Heat & Thermodynamics, S. Chand & Co., (1983).
3. D. Jeyaraman. Dr. K. Ilangovan and S. Visvanathan, Thermal Physics & Statistical Mechanics, (2009).

(For Candidates admitted from the academic year 2020-21 onwards) HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI- 620 002

SCHOOL OF PHYSICAL SCIENCES

PG & RESEARCH DEPARTMENT OF PHYSICS
CHOICE BASED CREDIT SYSTEM

B.Sc. MATHEMATICS

First Year - Semester – II

Course Title	ALLIED PHYSICS PAPER 3: MODERN PHYSICS, ELECTRICITY AND ELECTRONICS
Total Hours	60
Hours/Week	4 Hrs /Wk
Code	U20PH2ALT04
Course Type	Theory
Credits	2
Marks	100

General objective: To understand the vector model of an atom, the liquid drop model for nucleus, Basic concepts of electricity, electromagnetism and semiconductor devices.

Course objectives (CO):

    The Leaner will be able to:

CO No.	Course Objectives
CO-1	Understand and analyze photoelectric effect in different cells in atomic physics.
CO-2	Understand radioactivity, nuclear fission and fusion process in nuclear physics.
CO-3	apply and analyze the basic concepts and properties of Electricity.
CO-4	remember the electromagnetism principles and apply them.
CO-5	understand the semiconductor devices and its applications

UNIT I   ATOMIC PHYSICS   **(12 Hrs)**

Photo electric effect - Laws of photoelectric effect - Einstein's equation - applications of Photo electric effect- Photo electric cells -Applications of photoelectric cells-Vector Atom Model - Pauli's Exclusion Principle.

Wave mechanics: De Broglie concept of matter waves - characteristics and calculation of De Broglie wave length -Study of De Broglie matter wave by G.P.Thomson experiment - Heisenberg's uncertainty principle – illustration of uncertainty principle.

Extra reading / Key words: *Photoelectrons, Bragg's law*

UNIT II   NUCLEAR PHYSICS   (12 Hrs)

Nucleus size, charge, mass, spin -nuclear forces -nuclear fission and fusion (Quantitative study only) - Nuclear Model - Liquid drop model-shell model-Radioactivity - properties of radioactive radiations- law of radioactive disintegration -Mean life- half life period -law of Successive disintegration -Applications of radio isotopes: radio carbon dating.

Extra reading / Key words: *Dispersion, Hertz effect*

UNIT III   ELECTRICITY   (12 Hrs)

Electrostatics - Coulomb's inverse square law - electric field- electric field intensity- electric potential- electric flux - Gauss theorem and its applications (Intensity at a point due to a charged sphere & cylinder) -Principle of a capacitor-capacitance of a spherical capacitor with outer and inner sphere earthed - capacitance of a cylindrical capacitor - energy stored in a charged capacitor - Loss of energy on sharing of charges between two capacitors.

Extra reading / Key words: Charge, Discharge, Surface charge density

UNIT IV   ELECTROMAGNETISM   (12 Hrs)

Force on a current carrying conductor - Flemings left hand rule -Laws of electromagnetic induction-Self induction -self inductance of a long solenoid-Mutual induction- coefficient of coupling- determination of coefficient of Self inductance by Anderson's method- determination of coefficient of mutual inductance by Rayleigh's method.

Extra reading / Key words: *Potential difference, Torque, Magnetic field*

UNIT V   SEMICONDUCTOR DEVICES   (12 Hrs)

Semiconductors -doping - intrinsic and extrinsic semiconductor -PN junction diode- formation PN junction - volt-ampere characteristics of PN junction - junction diode as a rectifier - bridge rectifier - Zener diode - breakdown mechanism - Zener as a voltage regulator- Principle and working of a transistor- Characteristics of a transistor in CE configuration-transistor as an amplifier - construction of AND, OR and NOT logical gates using diodes and transistors.

Extra reading / Key words: *Breakdown, Operational amplifier, Logic operations*

Course Outcomes:

The Leaner will be able to:

CO No.	Course Outcomes	PSOs Addressed	Cognitive Level
CO-1	Analyze photoelectric effect in different cells in atomic physics.	PSO 6	U, An
CO-2	Describe radioactivity, nuclear fission and fusion process and calculate mean life for various elements in nuclear physics.	PSO 4	U,Ap
CO-3	Explain the principle of Capacitor.	PSO 1	R, U
CO-4	Describe the working of Anderson's method.	PSO 2	R, U
CO-5	Explain the working and characteristics of semiconductor diodes and analyze transistor as an amplifier.	PSO 2	U

PO – Programme Outcomes; CO – Course Outcome; R- Remember; U- Understand; Ap – Apply;
An – Analyse; E- Evaluate; C – Create

BOOKS FOR STUDY

1. Murugesan R Allied Physics, New Delhi, S. Chand & Co. Ltd (2005).
2. Murughesan , Modern Physics, S. Chand & Company Ltd, New Delhi, (2006).
3. Brijlal and Subramaniam, Electricity and Magnetism, RatanPrakashanMandir, New Delhi (1987)
4. V.Vijayendran, Introduction to Integrated Electronics, S. Viswanathan publishers (2009).

BOOKS FOR REFERENCE

1. Gupta and Kumar, Hand Book of Electronics, Pragathi Prakashan, Meerut (1980).
2. Jain, R.P., Modern Digital Electronics, Tata McGraw Hill India Ltd., New Delhi, Fourth Edition (2010).
3. J.B Rajam,Atomic Physics, S.Chand & Co., New Delhi (2010).
4. SathyaPrakash, Nuclear Physics and Particle Physics, S.Chand & Co.,New Delhi(2005)

(For Candidates admitted from the academic year 2020-21 onwards) HOLY CROSS COLLEGE (AUTONOMOUS) TIRUCHIRAPPALLI- 620 002

SCHOOL OF PHYSICAL SCIENCES

PG & RESEARCH DEPARTMENT OF PHYSICS
CHOICE BASED CREDIT SYSTEM

B.Sc. PHYSICS

First Year - Semester – II

Course Title	INDUSTRIAL RELATIONS: PHOTOVOLTAIC SYSTEMS
Total Hours	15
Hours/Week	1 Hr /Wk
Code	U20PH2IRT01
Course Type	Theory
Credits	1
Marks	100

UNIT I   **ELECTRONIC REALIZATION**   **(3 Hrs)**

Introduction to PN junction, semiconductor, transistor, MOSFET, IGPT-Testing and measuring of semiconductor-Introduction to static switching device in solar industries-Function of transformerless inverter in solar industries.

UNIT II   **RENEWABLE ENERGY SOURCES**   **(3 Hrs)**

Introduction to Renewable energy-Types of renewable energy-Energy: Introduction to solar energy and wind energy-Solar Energy conversion and efficiency.

UNIT III   **SOLAR PHOTOVOLTAIC SYSTEMS**   **(3 Hrs)**

Introduction to solar cells-Types of solar cells, function and characteristic of solar cells- Spectral power distribution of solar radiation-Solar PV systems-Solar on-grid, off-grid system- Merits and demerits On grid & Off grid system-Introduction

to Max. Power Point Tracking (MPPT) charger and its working principle.

UNIT IV   SOLAR ENERGY APPLICATIONS   (3 Hrs)

Solar thermal system-Solar water heater and its types-Function and uses of solar water heater in domestic and industries-Procedure for installing solar water heater.

UNIT VINSTALLATION DESIGN & EVALUATION OF SOLAR SYSTEM (3Hrs)

Calculation of solar system for the project-Bi directional Watt/hour meter and its uses- Structural design of installing panels-Protection devices for panels-Testing of solar panels- Switch ON and OFF- procedure for On grid and Off grid solar systems.

BOOK FOR STUDY

Study materials.