DEPARTMENT OF PHYSICS

HOLY CROSS COLLEGE (Autonomous),Nagercoil-629004

Teaching Plan

Semester: I

Course Name: MECHANICS
Course code: PC2011

No of hours per week	No of credits	Total no of hours	Marks
4	4	60	100

Objective: To impart knowledge on basic aspects of dynamics, conservation laws, kinematics, collisions and elasticity.

Course Outcomes

COs	Upon completion of this course, students will be able to	PSO addressed	CL
CO – 1	understand and define the laws involved in mechanics	PSO1	U
CO – 2	apply conservation laws in collision experiments	PSO2	Ap
CO – 3	interpret the principles of gravitation and moment of inertia through theory and experiments	PSO3	Ap
CO – 4	analyze the fundamentals of center of mass and rocket motion	PSO2	An
CO – 5	apply pressure-velocity relation in fluid flow in the field of fluid dynamics	PSO3	Ap

Modules

Credits: 4 Total contact hours: 60 (Including assignments and tests)

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I	**Laws of Motion**					
	1	Laws of conservation of energy, linear momentum and angular momentum – work energy theorem	**2**	To understand the concept of conservation of energy.	Lecture Discussion with PPT illustration	Evaluation through short test Multiple choice questions
	2	work done by gravitational force – work done by spring force – potential energy – conservative and non conservative forces – potential energy curve	**2**	To be able to derive the workdone by gravitational and spring force and distinguish conservative and non conservative forces	Lecture discussion with illustration	Formative assessment I
	3	Collision – Elastic and inelastic collision(Fundamental laws of impact) – Newton's law of impact – coefficient of restitution	**3**	To know the principles of collision	Lecture discussion	

	4	Impact of a smooth sphere on a fixed plane – Direct impact between two smooth spheres – Oblique impact between two smooth spheres – Calculation of final velocities of the spheres – Loss of K.E due to impact	**3**	To distinguish between direct impact and oblique impact between two smooth spheres	Lecture discussion	
II	**Dynamics of Rigid Body**					
	1	Moment of inertia – Theorems of perpendicular and parallel axes	**2**	To understand the concept moment of inertia	Lecture Illustration	Short test Quiz Assignment Formative assessment
	2	M.I of a circular ring, disc, solid sphere, hollow sphere and cylinder about all axes	**3**	To categorize moment of inertia of different objects.	Lecture discussion	
	3	Compound pendulum – theory – equivalent simple pendulum – reversibility of centers of oscillation and suspension – determination of g and k	**4**	To be able to find the acceleration due to gravity at a place	Lecture Illustration	
III	**Gravitation**					
	1	Newton's law of gravitation – Kepler's laws of gravitation – G by Boy's method – Mass and density of earth	**2**	To recall the concept of collision and to recognize the impact of smooth spheres.	Lecture with PPT Illustration	Formative assessment II
	2	Acceleration due to gravity – Variation of g with altitude, depth and rotation of earth – Value of g at poles and equator	3	To understand the variation of g with altitude, depth and rotation of earth	Question-answer session Lecture	

	3	Gravitational field – Gravitational potential – Gravitational potential due to spherical shell – Gravitational potential due to a solid sphere (inside and outside)	3	To understand the concept gravitational potential	Lecture with PPT Illustration	
IV	**Central Force Motion**					
	1	Angular velocity, angular momentum and K.E of rotation – Torque and angular acceleration – Relation between them – Expression for acceleration of a body rolling down an inclined plane without slipping	3	To acquire knowledge on angular velocity and angular momentum.	Lecture Discussion	Formative assessment II
	2	Center of mass – Velocity and acceleration of centre of mass – Determination of motion of individual particle – System of variable mass. Rocket motion– Satellite	6	To understand the concept centre of mass	Lecture Discussion	
V	**Statics and Hydrodynamics**					
	1	Friction-laws of friction–Angle of friction– Cone of friction – Centre of gravity – Solid and hollow tetrahedron– solid and hollow hemisphere	3	To have practical knowledge on angle of friction and cone of friction	Lecture with PPT	Short test Formative assessment III

	2	Centre of pressure– vertical rectangular lamina – vertical triangular lamina	3	To understand the concept rectangular and triangular lamina.	Brain storming session. Lecture Illustration	
	3	Hydrodynamics – Equation of continuity– Pitot's tube and Venturimeter – Euler's equation of unidirectional flow – Torricelli's theorem – Bernoulli's theorem and its applications	3	To be able to understand the principles in hydrodynamic s.	Lecture with PPT Illustration	

CO- Course Outcome; CL-Cognitive Level; R- Remember; U- Understand; Ap- Apply; C - Create.

Course Instructors: Dr.LeslyFathima & Sr.Sebastiammal

Semester: I
Course Name: Allied Physics I
Course code: AP2011

No of hours per week	No of credits	Total no of hours	Marks
4	4	60	100

Objectives

To understand the concept of strength of materials, viscous properties of liquids, heat transformation from one place to another, converting heat to do mechanical work and basic properties of light such as interference and diffraction.

Course Outcomes

CO	Upon completion of this course the students will be able to:	PSO addressed	CL
CO – 1	Understand the fundamental concepts of Physics.	PSO-1	U
CO – 2	Analyse the concepts and study the applications of Thermodynamics, material properties heat and optics.	PSO-2	An
CO – 3	Apply their depth knowledge of Physics in day today life.	PSO-3	Ap
CO – 4	Develop their knowledge and carry out the practical by applying these concepts	PSO-5	R

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I	**Properties of Matter**					
	1	Young's modulus – Rigidity modulus – Bulk modulus – Poisson's ratio (definition alone)	2	To understand the basic concepts of Young's modulus and its definition	Illustration and lecture	Evaluation through: quiz, short questions Multiple choice, questions , Deriving theoretical Formulas Problem solving Formative assessment
		Bending of beams – Expression for bending moment	1	To study the Bending of beams and define Expression for bending moment	Illustration and theoretical derivation	
	2	Determination of Young' modulus – uniform and non uniform bending. Expression for Couple per unit twist	2	To determine uniform and non-uniform bending and study couple per unit twist	Illustration, theoretical derivation and Practical	
	3	Work done in twisting a wire – Torsional oscillations of a body– Rigidity modulus of a wire and M.I. of a disc by torsion pendulum	3	To understand working of torsion pendulum	Lecture and theoretical derivation	
II	**Viscosity**					
	1	Viscosity – Viscous force – Co-efficient of viscosity – Units and dimensions	3	To understand the basic concepts of viscosity and study its units	Illustration, Theoretical formulation Problem Solving	Evaluation through: quiz, short test Assignment on applications. Problem Solving Formative assessment
	2	Poiseuille's formula for co-efficient of viscosity of a liquid – Determination of co- efficient of viscosity using burette and comparison of Viscosities.	3	To determine Poiseuille's formula and determine the co-efficient	Lecture , Theoretical formulation Practical demonstration	
	3	Bernoulli's theorem – Statemen and proof – Venturimeter – Pitot tube.	2	To understand the concept of venturimeter and Pitot tube.	Lecture , Illustration, Theoritical formulation Practical	
III	**Conduction, Convection and Radiation**					
	1	Specific heat capacity of solids and liquids – Dulong and Pettit's law	2	To understand the basic concepts of specific heat capacity	Illustration and lecture	Evaluation through: quiz, short questions

	2	Newton's law of cooling – Specific heat capacity of a liquid by cooling	2	To use the law of Newtons law of cooling to find specific capacity of liquid	Illustration and theoretical derivation	Multiple choice, questions , Deriving theoretical formulas Formative assessment
	3	Thermal conduction –Coefficient of thermal conductivity by Lee's disc method.	1	To understand the basic concepts of conduction mode of heat transfer through experiment	Illustration, theoretical derivation and Demonstration	
	4	Convection process – Lapse rate – Greenhouse effect	1	To define convection mode of heat transfer and study its application	Illustration and lecture	
	5	Black body radiation – Planck's radiation law – Rayleigh Jean's law, Wien's displacement law – Stefan's law of radiation.	2	To deduce laws related to heat transfer through radiation	Illustration, theoretical derivation and Demonstration	
IV	**Thermodynamics**					
	1	Zeroth and First Law of thermodynamics – Second law of thermodynamics	2	To understand the basic concepts of laws of thermodynamics	Lecture, Demonstration, theoretical formulation	Evaluation through: quiz, short questions Multiple choice, questions, Deriving theoretical formulas Formative assessment
	2	Carnot's engine and Carnot's cycle – Efficiency of a Carnot's engine	3	To analyse the various aspects of Carnot engine	Lecture, Demonstration, theoretical formulation	
	3	Entropy – Change in entropy in reversible and irreversible process – Change in entropy of a perfect gas – Change in entropy when ice is converted into steam.	3	To understand the concept of entropy and its applications	Lecture, Demonstration, theoretical formulation	
V	**Optics**					
	1	Interference – Conditions for interference maxima and minima – Air wedge – Thickness of a thin wire – Newton's rings – Determination of wavelength using Newton's rings.	3	To understand the basic concepts of interference phenomena and its application	Illustration, Theoretical formulation, Demonstration	Evaluation through: quiz, Deriving theoretical formulas
	2	Diffraction – Difference between diffraction and interference –	2	To understand the basic concepts of	Lecture, Demonstration,	

		Theory of transmission grating – Normal incidence		diffraction phenomena and its application	Theoretical formulation	Assignment on applications
	3	Optical activity – Biot's laws – Specific rotatory power – Determination of specific rotatory power using Laurent's half shadepolarimeter.	3	To understand the basic concepts of optical activity phenomena and its application	Lecture, Demonstration, Theoretical formulation	Formative assessment

CO- Course Outcome; CL-Cognitive Level; R- Remember; U- Understand; Ap- Apply; C - Create.

Course Instructors: Ms.Aji Udahya

Semester I
Non Major Elective Course - I
Course Name: Physics in Everyday Life - I
Course Code: PNM201

No. of hours per week	No of credits	Total no of hours	Marks
2	2	30	100

Objectives

1. To introduce the basic concepts in physics and their applications in everyday life.
2. To understand the physics concept applied in day to day life situations.

Course Outcomes

CO	Upon completion of this course, students will be able to:	PSO's addresed	CL
CO – 1	understand their knowledge of basic scientific principles and fundamental concepts in physics.	PSO1	U
CO – 2	recall the various phenomena of sound waves applied in day today life	PSO2	R
CO – 3	understand the basic laws of physics and different forces involved in nature.	PSO1	Ap
CO – 4	explain the Physics concepts behind sports	PSO3	E
CO – 5	categorize different characteristic nature of light and its properties like refraction, reflection and diffraction.	PSO1	C

Total contact hours: 30 (Including lectures, assignments and tests)

Unit	Module	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I	**Properties of Matter, Heat and Thermodynamics**					
	1	Introduction- Elasticity- Elastic behaviour of materials- Elastic energy- Elastic and Plastic Deformation- Polymers and elastomers- Application of Elastic behaviour of materials	1	To understand the fundamental concepts in elastic behaviour of materials	Lecture, PPT	Quiz, test, Formative assessment (I)
	2	Surface Tension -Concept behind Surface Tension- Examples of surface Tension , Capillary action- Experiment- Examples of capillary action	2	To apply Surface tension effects in day today lie situation.	Lecture, Demonstration	
	3	Viscosity - definition - Applications of Viscosity.	1	To understand the concept viscosity	Lecture	

II	**Sound**					
	1	Introduction- frequency spectrum of Sound waves - The Human voice-How does the ear hears?-	1	To understand the basic properties of sound	Lecture, Demons-tration	Quiz test, Formative assessment
	2	Amazing Abilities of Sound Basic characteristics of sound-	1	To be able to understand the basic characteristics of sound	Lecture,	
	3	Reflection of Sound-echo-Interference -Application of reflection of sound wave	1	To understand the fundamental concept of reflection	Lecture	
	4	Ultra sound: Properties and applications of ultrasound-Applications of sound in human life.	1	To understand the applications of ultrasonic	Lecture, PPT	
III	**Mechanics**					
	1	Introduction- terms used in mechanics- Centripetal and centrifugal forces-	1	To understand Centripetal and centrifugal forces	Lecture	Assignments,

		Contact and non contact forces				
	2	Friction and its types- Newton's laws of motion- gravity	2	To understand friction and its types	Lecture, PPT	Formative assessment
	3	Mass and weight- Mechanics in everyday life.	1	To understand the relation between mass and weight and apply the mechanics in day to day life	Lecture, PPT	
IV	**Biomechanics in Sports**					
	1	Forces and torques in Bio Mechanics- Centre of gravity	1	To understand the forces, normal reaction, friction		Formative assessment
	2	Physics of walking – Physics of cycling – Physics of long jump	1		Lecture, PPT	
	3	Physics of swimming, volleyball and basketball	2	To understand the forces, normal reaction, friction,	Lecture, PPT	
V	**Renewable Energy**					

	1	Solar power – Applications - Wind power and applications - Applications - Hydroelectric power and its uses	2	Understand the natural power	Lecture, PPT	Quiz, Assignments
	2	Biogas plant and its advantages -	1	To use the biogas resources in day	Lecture, PPT	
	3	Advantages and disadvantages of renewable energy sources.	1	To understand the pros and cons of these resources	Lecture, PPT	

CO- Course Outcome; CL-Cognitive Level; R- Remember; U- Understand; Ap- Apply; C - Create.

Course Instructor: S.J.Jenepha Mary

Semester: III
Course Name: Heat and Thermodynamics
Course Code: PC2031

Hours /Week	Credits	Total Hours	Marks
4	**4**	**60**	**100**

Objectives

1. To understand the phenomena connected with various units of measurement of temperature, knowing the concept of specific heat capacities of matter and transmission ofheat.
2. To introduce the concept of lowering the temperature, liquefying gases and process of making heat to do mechanicalwork.

Course Outcomes

COs	Upon completion of this course, students will be able to:	PSO addressed	CL
CO-1	understand experimental methods to determine the transmission of heat.	**PSO - 4**	**U**
CO-2	analyze the work and heat interactions associated with a prescribed process path and to perform a analysis of a flow system	**PSO - 1**	**An**
CO-3	understand the basic concepts of thermodynamics like system, properties, equilibrium, pressure, specificvolume, temperature and the laws of thermodynamics	**PSO - 4**	**U**

CO-4	evaluate entropy changes in a wide range of processes and determine the reversibility or irreversibility of a process fromsuch calculations.	**PSO - 3**	**An**
CO-5	analyze Maxwell's thermo dynamical relations and their applications	**PSO - 5**	**E**

Teaching Plan

Total contact hours: 60 (Including lectures, assignments and Tests)

Unit	Module	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I	**Thermometry and Calorimetry**					
	1	Platinum resistance thermometer - Calendar and Griffith's bridge	1	Describe the theory behind different thermometers	Lecture discussion PPT	Multiple Choice Questions
	2	Thermoelectric effect – Seebeck effect - Thermoelectric thermometers- International temperature scale – Thermistor-	2	Able to explain thermoelectic effects	Lecture demonstration PPT	Quiz,
	3	Specific heat capacity of Solids – Regnault's method of mixtures(solid) – specific heat capacity of liquids – Callendar and Barnes method.	3	Able to determine the specific heat capacity of solids and liquids	Lecture demonstration PPT	Formative Assessment I

	4	Specific heat capacity of gases – Cp and Cv – Meyer's relation – Cv by Joly's differential steam calorimeter method – Cp by Regnault's method.	3	Able to determine the specific heat capacity of gasses.	PPT Lecture discussion	Assignment

II	**Low Temperature Physics**					
	1	Joule - Kelvin effect - Liquefaction of Air-Linde's Process –liquefaction of hydrogen - liquefaction of helium-Kammerling - Onne's method	3	Describing the process of liquefaction of gases by various methods	Lecture discussion PPT	Formative Assessment I &II
	2	Helium I and II - Lambda point - production of low temperatures - adiabatic demagnetization	3	Explain about the production of low temperatures	Lecture demonstration PPT	Multiple choice questions
	3	Practical applications of low temperature - refrigerators and air- conditioning machines - super fluidity - application of super fluidity.	3	Discuss about fluidity, low temperature and applications based on it	Group discussion, PPT	Quiz
III	**Transmission of Heat**					
	1	Conduction – coefficient of thermal conductivity – Rectilinear flow of heat along a bar	2	Explain the conduction process and rectilinear heat flow.	Lecture discussion, PPT	Multiple choice questions
	2	convection – lapse rate – Stability of the atmosphere – Newton's law of cooling – determination of specific heat capacity of liquid	3	Discuss the convection process of heat transfer.	Lecture discussion & Demonstration, PPT	Formative Assessment I &II

	3	Radiation - black body – Kirchhoff's law – Stefan – Boltzmann law- solar constant – water flowpyroheliometer.	2	Describe the process of radiation and laws associated with it.	PPT Lecture discussion	Short Test Quiz
	4	Energy distribution in black body spectrum - Wien's law – Rayleigh Jean's law– Planck's law	2	Comparing the theoretical and experimental results of energy distribution in black body.	Group discussion, PPT	Assignment
IV	**Kinetic Theory of Gases**					
	1	Kinetic Theory of gases- assumptions - Molecular collisions – mean free path – expression for mean free path	2	Able to explain the motion of gas molecules	Lecture discussion, PPT	Multiple choice questions
	2	Transport phenomenon – Brownian motion and its features - expression for viscosity, Diffusion and thermal conductivity of gas.	4	Describe the movement of molecules into different layers thus understanding the transport of gas	Lecture discussion & Demonstration, PPT	Formative Assessment I
	3	Experimental verification -Vander Waals' equation of state - Determination of Vander Waals' constant - Relation between Vander Waals' constant and critical constants.	3	Explain the correction in Ideal gas equation and finding the constants of correction and their relations	Lecture demonstration PPT	Short Quiz
V	**Thermodynamics**					

	1	Zeroth and first law of thermodynamics – reversible and irreversible processes – isothermal process-adiabatic process-gas equation during adiabatic process - work done during adiabatic and isothermal process	3	Discuss the zeroth law and first law of thermodyna modynamics	Lecture discussio n, PPT	Multiple Choice Questions
	2	second law of thermodynamics – Carnot's engine – its efficiency. Entropy – change of entropy in reversible and irreversible processes – temperature – entropy diagrams – physical significance of entropy - change of entropy when ice converted into steam	2	Discuss the law of thermodyna modynamics and entropy concept	Lecture discussio n, PPT	Quiz,
	3	third law of thermodynamics – Extensive and Intensive thermodynamic variables – distinction between them Maxwell thermodynamical relations – derivation and application - Clausius - Clapeyron equation and specific heat relation	4	Analyze and study the applications maxwells relation	Group discussio n, PPT	Formative Assessment II

Course Instructor: Dr.M.Abila Jeba Queen

Semester **III**

Course Name : Non Conventional Energy Sources -Elective – I(a)

Course Code : PC2032

No. of hours per week	No. of credits	Total No. of hours	Marks
4	4	60	100

Learning Objectives

1. To provide an understanding of the present energy crisis and various available energy sources.
2. To make the students to understand the present day crisis of need for conserving energy and their alternatives.

Course Outcome

COs	Upon completion of this course, students will be able to:	PSO addressed	CL
CO- 1	Apply the solar energy in various sectors. (industry, agriculture and domestic purposes)	**PSO-3**	**Ap**
CO- 2	Explain the basic principles of wind energy conversion, various Biomass conversion Processesand its classification.	**PSO- 1**	**U**
CO- 3	Discuss the geothermal energy resources and chemical energy resources. (fuel cells)	**PSO-2**	**An**
CO- 4	Solve the present and future energy crisis.	**PSO- 8**	**C**

Modules

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I	**Introduction to Energy Sources**					
	1	World's reserve of Commercial energy sources and their availability	3	To understand the energy resources available in Word	Illustration and lecture	Evaluation through: quiz, short questions
	2	India's production and reserves	2	To understand the availability of energy resources in India	Illustration and lecture	
	3	Conventional and non-conventional sources of energy, comparison	2	To compare Conventional and non-conventional	Illustration and lecture	Formative assessment

				sources of energy		
	4	Coal- Oil and natural gas – applications - merits and demerits.	2	To know the merits and demerits of fossil fuels	Illustration and lecture	
II	**Solar Thermal Energy**					
	1	Solar constant -Solar spectrum	0.5	To understand the phenomena of solar activity	Illustration, demonstration and lecture	Evaluation through: quiz, Multiple choice, questions, Formative assessment
	2	Solar radiations outside earth's atmosphere –at the earth surface- on tilted surfaces	2.5	To understand the basic concepts of solar radiation towards earth	Illustration, demonstration and lecture	
	3	Solar Radiation geometry	0.5	To understand the different terms with solar radiation geometry	Illustration, lecture and Demonstration	
	4	Basic Principles of Liquid flat plate collector	1	To understand the principles of solar collector	lecture and Demonstration	
	5	Materials for flat plate collector -Construction and working	1.5	To explain the construction and working of Flat plate collector	Group Discussion	Multiple choice, questions,
	6	Solar distillation- Solar drying- Solar cooker (box type)-Solar water heating systems – Swimming pool heating.	3	To design the various Pollution free energy resources	Lecture with ppt, Group Discussion	Exhibiting Models, Formative assessment
III	**Photovoltaic Systems**					

	1	Introduction-Photovoltaic principle-Basic Silicon Solar cell- Power output and conversion efficiency	3	To understand the basic principle of Solar cell and study its efficiency	Lecture with ppt, Group Discussion	Evaluation through: quiz, Assignments Multiple choice questions Descriptive answers Formative assessment
	2	Limitation to photovoltaic efficiency-Basic photovoltaic system for power generation-Advantages and disadvantages	3	Able to utilize the solar energy for generating power	Lecture discussion	
	3	Types of solar cells	1	Able to discuss about the various types of solar cell	Lecture discussion	
	4	Application of solar photovoltaic systems - PV Powered fan – PV powered area - lighting system – A Hybrid System.	3	Apply the solar energy in various sectors	Lecture discussion	
IV	**Biomass Energy**					
	1	Introduction-Biomass classification- Photosynthesis - Biomass conversion technologies-Bio-gas generation-Factors affecting bio-digestion	3	To understand the fundamentals of Biomass conversion processes& devices	Lecture discussion	Evaluation through: quiz Assignments Short questions Descriptive answers

						Formative assessment
	2	Working of biogas plant-floating and fixed dome type plant -advantages and disadvantage	3	To bring awareness from a technical point of view of Bio gas plants	Lecture, Illustration, Group discussion	
	3	Bio-gas from plant wastes	1	To understand and apply the concept of production of bio-gas from plant wastes	Lecture, Illustration, Group discussion	
	4	Methods for obtaining energy from biomass. Advantage & disadvantages of biomass as energy source	2	To discuss about the generation of biogas from biomass	Lecture discussion	
V	**Wind Energy and Other Energy Sources**					
	1	Wind Energy Conversion-Classification and description of wind machines, wind energy collectors-Energy storage	3	To understand the basic concepts of WECS system	Illustration, lecture, Demonstration	Evaluation through: quiz, Assignments on applications Formative assessment
	2	Energy from Oceans and Chemical energy resources-Ocean thermal energy conversion-tidal power, advantages and limitations of tidal power generation-Energy and power from waves- wave energy conversion devices	3	To understandthe basic conceptsof OTEC and Wave energy	Lecture, Demonstration,	
	3	Fuel cells- and application of fuel cells- batteries- advantages of battery for bulk energy storage- Hydrogen as alternative fuel for motor vehicles.	3	To understandthe basic conceptsof Chemical energy	Lecture, Demonstration,	
	4					

CO-Course Outcome; CL-Cognitive Level; R- Remember; U- Understand; Ap-Apply; An-Analyze; C - Create.

Course Instructors: Dr. R. Krishna Priya& Ms. P. AjiUdhaya

Semester III

Course Name : Allied Physics I for Chemistry

Course code : AP2031

No of hours per week	No of credits	Total no of hours	Marks
4	4	60	100

Learning Objectives

1. To understand the concept of strength of materials, viscous properties of Liquids, heat transformation from one place to another, converting heat to do mechanical work.
2. To understand basic properties of light such as interference and diffraction.

Course Outcome

COs	Upon completion of this course students will be able to:	PSO addressed	CL
CO- 1	Understand to know, various modulus involved in the materials, flow of liquids due to viscous forces, transmission of heat due to process of conduction, convection and radiation and various laws involved in heat transformation, various thermodynamic laws and.	PSO-1	U
CO -2	Analyze the concepts and study the concept of entropy, and the phenomenon like interference and diffraction, optical activity of liquids and its uses.	PSO -3	An
CO- 3	Apply their depth knowledge of Physics in day today life.	PSO -2	Ap
CO- 4	Develop their knowledge and carry out the practical by applying these concepts	PSO -4	R

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I	Properties of Matter					

	1	Young's modulus – Rigidity modulus – Bulk modulus – Poisson's ratio (definition alone)	2	To understand the basic conceptsof Young's modulus and itsdefinition	Illustration and lecture	Evaluation through: quiz, short questions Multiple choice, questions , Deriving theoretical Formulas Problem solving Formative assessment
		Bending of beams – Expression for bending moment	1	To study the Bending of beams and define Expressionfor bending moment	Illustration and theoretical derivation	
	2	Determination of Young' modulus – uniform and non uniform bending. Expression for Couple per unit twist	3	To determine uniform and non-uniform bending and study couple per unit twist	Illustration, theoretical derivation and Practical	
	3	Work done in twisting a wire – Torsional oscillations of a body– Rigidity modulus of a wire and M.I. of a disc by torsion pendulum	3	To understand working oftorsion pendulum	Lecture and theoretical derivation	
II	**Conduction in solids**					
	1	Thermal conductivity – Lee's disc method – Relation between thermal and electrical conductivities - Widemann – Franz law	3	To understand the basic concepts of conduction phenomena and derive related laws	Illustration, theoretical derivation and lecture	Evaluation through: quiz, short questions Multiple choice, questions , Deriving theoretical formulas Formative assessment
	2	Convection: Newton's law of cooling – Determination of specific heat capacity of liquid	3	To understand the basic concepts of convection phenomena and derive related laws	Illustration and theoretical derivation	
	3	Radiation: Distribution of energy in the spectrum of black body – Results.	3	To understand the basic concepts of radiation phenomena and derive related laws	Illustration, theoretical derivation and Demonstration	
	Viscosity					

III	1	Viscosity – Viscous force – Co-efficient of viscosity – Units and dimensions	3	To understand the basic concepts of viscosity and study its units	Illustration, Theoretical formulation Problem Solving	Evaluation through: quiz, short questions
	2	Poiseuille's formula for co-efficient of viscosity of a liquid – Determination of co- efficient of viscosity using burette and comparison of Viscosities.	3	To determine Poiseuille's formula and determine the co-efficient	Lecture , Theoretical formulation Practical demonstration	Multiple choice, questions , Deriving theoretical formulas Formative assessment
	3	Bernoulli's theorem – Statemen and proof – Venturimeter – Pitot tube.	3	To understand the concept of venturimeter and Pitottube.	Lecture , Illustration, Theoritical formulation Practical	
IV	**Thermodynamics**					
	1	Zeroth and First Law of thermodynamics – Second lawof thermodynamics	2	To understand the basic concepts of laws of thermodynamics	Lecture, Demonstration, theoretical formulation	Evaluation through: quiz, short questions Multiple choice, questions, Deriving theoretical formulas Formative assessment
	2	Carnot's engine and Carnot's cycle – Efficiency of a Carnot's engine	3	To analyse the various aspects of Carnot engine	Lecture, Demonstration, theoretical formulation	
	3	Entropy – Change in entropy in reversible and irreversible process – Change in entropy of a perfect gas – Change in entropy when ice is converted into steam.	3	To understand the concept of entropy and its applications	Lecture, Demonstration, theoretical formulation	
V	**Optics**					
	1	Interference – Conditions for interference maxima and minima – Air wedge – Thickness of a thin wire – Newton's rings – Determination of wavelength using Newton's rings.	3	To understand the basic concepts of interference phenomena and itsapplication	Illustration, Theoretical formulation, Demonstration	Evaluation through: quiz, Deriving theoretical formulas
	2	Diffraction – Differencebetween diffraction and interference –	3	To understandthe basic conceptsof	Lecture, Demonstration,	

		Theory of transmission grating – Normal incidence		diffraction phenomena and its application	Theoretical formulation	Assignment on applications
	3	Optical activity – Biot's laws– Specific rotatory power – Determination of specific rotatory power using Laurent's half shadepolarimeter.	3	To understandthe basic conceptsof optical activity phenomena and its application	Lecture, Demonstration, Theoretical formulation	Formative assessment

CO- Course Outcome; CL-Cognitive Level; R- Remember; U- Understand; Ap-Apply; C - Create.

Course Instructors: Ms. S. Virgin Jeba

DEPARTMENT OF PHYSICS

HOLY CROSS COLLEGE (Autonomous), Nagercoil-629004

III BSc Physics

Teaching Plan

Semester V

Major Core –V

Name of the Course : Classical and Statistical Mechanics

Subject code : PC2051

Hours/Week	Credits	Total Hours	Marks
6	5	90	100

Learning Objectives

1. To understand the mechanics of systems of particles and their equations of motion
2. To study the concept of statistics of molecules.

Course Outcome

COs	Upon completion of this course, students will be able to:	PSO addressed	CL
CO- 1	understand the basic mechanical concepts related to system of particles	PSO-1	U
CO-2	apply various mechanical principles to find solution for physical problem	PSO-4	Ap
CO- 3	solve the equations of motion using Hamiltonian formalism	PSO-6	C
CO- 4	explain the fundamental postulates of statistical mechanics and Maxwell Boltzmann statistics	PSO-1	R
CO- 5	understand and develop a scientific knowledge in quantum statistics	PSO-7	U

Modules

Credits: 5 Total contact hours: 90 (Including assignments and tests)

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I	**Mechanics of a System of Particles**					
	1	External and internal forces, center of mass	4	To be able to differentiate external and internal forces	Lecture Discussion with PPT illustration	Evaluation through Online quiz Class test Formative assessment I
	2	Conservation of linear momentum- Conservation of angular momentum- Conservation of energy- work- energy theorem-	4	To acquire knowledge on conservation of momentum and Energy	Lecture discussion SLO	
	3	Conservative forces- examples- Constraints-Types of constraints- Examples- Degree of freedom-	4	To understand the different types of constraints	Lecture discussion	
	4.	Generalized coordinates (transformation equations) – Generalized Velocities- Generalized Momentum.	3	To acquire knowledge on Generalized coordinates	Lecture discussion, PPT	
II	**Lagrangian Formulations**					
	1	Principle of virtual work, D'Alembert's principle	4	To know the principle of virtual work	Lecture Discussion with PPT Illustration	Short test Quiz Assignment
	2	Lagrange's equation	4	To understand	Lecture	

		of motion for conservative and non conservative systems		the concept Lagrange's equation of motion	discussion	Formative assessment I
	3	Simple applications- simple pendulum- Atwood's machine- compound pendulum	3	To be able to derive Lagrange's equation of motion in simple systems	Lecture Illustration	
	4	Hamilton's principle- Deduction of Lagrange's equation of motion from Hamilton's principle - Deduction of Hamilton's principle from D'Alembert's principle	4	To acquire knowledge on Hamilton's principle		
III	**Hamiltonian Formulations**					
	1	Phase space- The Hamiltonian function H- Hamilton's Canonical equation of motion	5	To acquire knowledge on Hamiltonian function	Lecture with PPT Illustration	Evaluation through Online quiz Assignment Formative assessment II
	2	Physical significance of H-Deduction of Canonical equation from a variational principle	5	To be able to deduce Canonical equation from a variational principle	Question-answer session Lecture	
	3	Applications- Harmonic Oscillator- Planetary motion- Compound pendulum	5	To be able to derive Hamilton's Canonical equation of motion in simple systems	Lecture discussion with illustration, SLO	
IV	**Classical Statistics**					
	1	Micro and macro	5	To understand	Lecture	Evaluation

		states- The mu-space and gamma space- fundamental postulates of statistical mechanics		the concept Micro and macro states	Discussion	through Online quiz Formative assessment II
	2	Ensembles- different types- Thermodynamical probability - entropy and probability	5	To acquire knowledge on Ensembles	Lecture Discussion	
	3	Boltzmann's theorem- Maxwell- Boltzmann statistics- Maxwell-Boltzmann energy distributive law- Maxwell- Boltzmann velocity distributive law.	5	To acquire knowledge Maxwell-Boltzmann velocity distributive law	Brain storming session. Lecture Illustration	
V	**Quantum Statistics**					
	1	Development of Quantum statistics- Bose- Einstein and Fermi- Dirac statistics-	5	To have clear idea about Quantum statistics	Lecture with PPT	Short test Formative assessment III
	2	Derivation of Planck's radiation formula from Bose–Einstein statistics	5	To be able to derive Planck's radiation formula from Bose Einstein statistics	Brain storming session. Lecture Illustration	
	3	Free electrons in metal- Fermi Gas- Difference between classical and quantum statistics	5	To be able to mention the difference between classical and quantum statistics	Lecture with PPT Illustration	

PO- Program outcome; LO – Learning outcome; Cognitive Level U – Understand; Ap- Apply, An- Analyze;

Course instructors: Dr.A.Lesly Fathima, Dr.S.Sonia and Dr.S.J Jenepha MaryHead of the Department: Dr. C. Nirmala Louis

Holy Cross College (Autonomous), Nagercoil-629004
B.Sc Physics

Semester V

Name of the Course: Analog Electronics: Major Core –VI

Subject Code : PC2052

No. of hours per week	No. of credits	Total No. of hours	Marks
6	5	90	100

Learning Objectives

1. To impart in depth knowledge about Semiconductors, diodes, Transistors, Operational Amplifiers, oscillators etc
2. To enable the students to understand the aspects of analog electronics in a lucid and comprehensive manner.

Course Outcome

COs	Upon completion of this course, students will be able to:	PSO addressed	CL
CO-1	understand the fundamental principles of semiconductors including P-N junctions and zener diode	**PSO-1**	**U**
CO-2	illustrate network theorems like Thevenin's theorem, Norton's theorem etc.,	**PSO-2**	**U**
CO-3	Analyzethe operation of transistor , amplifier, oscillator and multivibrator	**PSO-3**	**E**
CO-4	demonstrate practical skills in the simulation, construction and testing of simple electrical and electronic circuits.	**PSO-6**	**Ap**

Modules

Credits: 5 Total contact hours: 90 (Including lectures, assignments and tests)

Unit	Module	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I	**Linear circuit analysis and semiconductor diodes**					
	1	Constant voltage source - constant current source - Maximum power transfer theorem - Thevenin's theorem - procedure for finding Thevenin Equivalent circuit	4	To apply the usage of constant voltage source and current source in Thevenin's circuit	Lecture Discussion and Problem Solving	Evaluation through: quiz, short questions
	2	PN junction theory - V-I characteristics of a PN junction diode - Half wave rectifier - Bridge rectifier - Efficiency	4	To understand the fundamental principles of PN junction. To calculate the efficiency of rectifier circuits	Lecture Discussion and Problem Solving	Formative assessment
	3	filters - Shunt capacitor filter – pi filter - Zener diode - equivalent circuit - voltage regulator	3	To understand the various filter circuits. To study about the usage of filter circuits on voltage regulator	Lecture Discussion and Problem Solving	
	4	LED - V-I characteristics – advantages - applications - photo diode - characteristics applications.	4	To understand the principle and working of LED and photodiode	Discussion and lecture	
II	**Transistor Amplifier**					
	1	Transistor - Different modes of	3	To understand	Demonstration	

		operations-CB mode &CE mode		the different modes of transistor operations	and lecture	Evaluation through: quiz, Multiple choice, question s, Formative assessment
	2	Two port representation of a transistor- h parameter - AC equivalent circuit using h parameters- analysis of amplifiers using h parameters (CE only)	3	To apply the h parameters in analyzing the amplifiers	demonstration and lecture – cum-discussion, Problem Solving	
	3	RC coupled amplifier - transformer coupled amplifier	3	To understand RC coupled and transformer coupled amplifier	Lecture-cum-Discussion and Demonstration	
	4	Power amplifier	2	To understand the principles and working of Power amplifier	Lecture- cum-discussion	
	5	Classification of amplifiers - Class A, Class B and Class C	2	To compare Class A, Class B and Class C amplifiers	Group Discussion and lecture	Multiple choice, question s,
	6	Push pull amplifier – Emitter follower	2	To understand Push pull amplifier and emitter follower	Lecture, Group Discussion	Formative assessment
III	**Oscillators and Multivibrator**					
	1	Principle -effect negative feedback-and Barkhaussen criterion	3	To understand aboutfeedback principle of oscillators	Lecture-cum-discussion, Problem solving	Evaluation through: quiz, Assignments
	2	Phase shift and Wien Bridge oscillators using transistors – Expression for frequency	4	To derive the expression of frequency of phase shift and Wein Bridge oscillators.	Lecture discussion, Problem solving	Multiple choice questions
	3	Multivibrators-Astable and ,Monostable	4	To discuss about Astable and	Demonstration, Lecture-cum-discussion	Descriptive

				MonostableMultivibrators		answers
	4	Bistable multi vibrators using transistors - Schmitt trigger.	4	To discuss about bistableMultivibrator	Demonstration, Lecture-cum-discussion	Formative assessment
IV	**Special Semiconductor Devices**					
	1	Clipping and clamping circuits	3	To understand about clipping and clamping circuits	Lecture-cum-discussion	Evaluation through: quiz Assignments Short questions Descriptive answers Formative assessment
	2	Differentiating circuit - Integrating circuit	3	To construct the differentiator and integrator circuits.	Lecture, Demonstration, Group discussion	
	3	Field effect Transistor FET-MOSFET	3	To understand about FET transistor	Lecture-cum-discussion	
	4	UJT-SCR -characteristics - FET as a VVR	3	To discuss about the characteristics of FET	Lecture-cum-discussion	
	5	UJT relaxation oscillator-SCR as a switch and rectifier	3	The understand about the principles of UJT relaxation oscillator	Lecture-cum-discussion	
V	**Operational Amplifier**					
	1	Operational Amplifier-characteristics-parameters-applications- Inverting amplifier - Non inverting amplifier	4	To understand the basic concepts of operational Amplifier, inverting and non-inverting	Lecture-cum-discussion, Demonstration	Evaluation through: quiz, Assignments on operational amplifier problems Formative assessment
	2	Voltage follower- Adder - Subtractor - Integrator – Differentiator	4	To construct the differentiator and integrator circuits using IC 741	Lecture-cum-discussion, Demonstration	
	3	Solving simultaneous equations-comparator -square wave generator	4	To solve the simultaneous equations using Op-amp.	Lecture-cum-discussion, Demonstration	

	4	Wien bridge oscillator -Schmitt trigger	3	To construct the Schmitt trigger using IC741	Lecture-cum-discussion, Demonstration	

CO-Course Outcome; CL-Cognitive Level; R- Remember; U- Understand; Evaluate-E; Ap-Apply; An-Analyze; C - Create.

Course Instructors: Dr. R. Krishna Priya & Dr. M. Priya Dharshini

HOLY CROSS COLLEGE (Autonomous), Nagercoil-629004

BSc Physics

Semester V

Major Core VII: Solid State Physics

Course Code: PC2053

Hours/Week	Credits	Total hours	Marks
5	5	75	100

Learning Objectives

1. To impart knowledge on the structure of crystals and the different types of materials.
2. To develop a scientific attitude at micro and nano scales of materials

Course Outcomes

COs	Upon completion of this course, students will be able to:	PSO addressed	CL
CO - 1	illustrate various types of bonding present in solids with example.	**PSO - 1**	**U**
CO - 2	explain the various crystal parameters and structures.	**PSO - 3**	**E**
CO - 3	discuss the various theories involved in magnetic materials. (dia, para, ferro, ferri and antiferro magnetism)	**PSO - 3**	**C**
CO - 4	describe polarization processes and analyze the information contained in the temperature and frequency dependence of dielectric materials.	**PSO - 1**	**C**
CO - 5	analyze the structure and physical properties of semiconductors.	**PSO - 5**	**An**
CO - 6	describe and discuss the theory of superconductivity and superconducting materials.	**PSO - 2**	**C**

Modules

Credits: 5 **Total contact hours: 75 (Including assignments and tests)**

Unit	Section	Topics	Lecture hours	Learning outcome	Pedagogy	Assessment/ Evaluation
I	**Bonding in Solids**					
	1	Types of bonds in crystals - Ionic, covalent, Metallic, Vander waal's and Hydrogen Bonding	3	To understand the fundamental principles of types of bonds in crystals	Lecture and Discussion	Evaluation through:

	2	Bond energy of sodium chloride molecule - variation of inter atomic force with inter atomic spacing	3	To analyze the variation of inter atomic force with inter atomic spacing	Lecture and Discussion	quiz, short questions
	3	Cohesive energy - cohesive energy of ionic solids - application to sodium chloride crystal	3	To understand the cohesive energy	Lecture Discussion and Problem Solving	Formative assessment
	4	Evaluation of Madelung constant for sodium chloride	3	To derive the Madelung constant for sodium chloride	Discussion and lecture	
II	**Crystal Structure and Crystal Diffraction**					
	1	Crystal Lattice -Primitive and unit cell-seven classes of crystal-Bravais Lattice- Miller Indices	3	To understand the seven classes of crystal	Demonstration and lecture	Evaluation through: quiz, Multiple choice, questions, Formative assessment
	2	Crystal Diffraction – Bragg's Law	3	To apply the Bragg's Law	demonstration and lecture –cum-discussion, Problem Solving	
	3	Experimental methods-Laue method, powder method and rotating crystal method	3	To understand the experimental methods	Lecture-cum-Discussion and Demonstration	
	4	Reciprocal lattice- Intensity and structure factor.	3	To analyze the reciprocal lattice	Lecture-cum-discussion	
III	**Magnetic Properties**					
	1	Spontaneous Magnetization – Weiss Theory – Temperature dependenceof Magnetization	3	To understand the Weiss Theory of Magnetization	Lecture-cum-discussion, Problem solving	Evaluation through: quiz, Assignments Multiple
	2	Classical Theory of Diamagnetism	3	To discuss the classical Theory of Diamagnetism	Lecture discussion, Problem	

					solving	choice questions Descriptive answers Formative assessment
	3	Weiss theory of Para magnetism – Ferromagnetic domains – Bloch wall	3	To understand the basics of Ferromagnetic domains	Demonstration, Lecture-cum-discussion	
	4	Basic ideas of anti- ferromagnetism – Ferri magnetisms – Ferrites in computer Memories.	3	To discuss aboutthe ferrites and its applications	Demonstration, Lecture-cum-discussion	
IV	**Dielectric Properties**					
	1	Band theory of solids – classification of insulators, Semiconductors, conductors	3	To understand the band theory of solids	Lecture-cum-discussion	Evaluation through: quiz Assignments Short questions Descriptive answers Formative assessment
	2	Intrinsic and extrinsic semiconductor	3	To understand and derive the Intrinsic and extrinsic semiconductor	Lecture, Demonstration, Group discussion	
	3	Carrier concentration for electron - Barrier Potential Calculation	2	To understand the carrier concentration for electron	Lecture-cum-discussion	
	4	Rectifier Equation Dielectrics - Polarization – frequency and temperature effects on polarization	2	To discuss about the Accelerators	Lecture-cum-discussion	
	5	Dielectric loss-Clausius Mosotti relation- determination of dielectric constants.	2	The understand about the principles of betatron and synchrotrons	Lecture-cum-discussion	
V	**SuperConductivity**					
	1	Introduction - General Properties of Superconductors - effect of magnetic field	3	To understand the basic concepts of Superconductors	Lecture-cum-discussion, Demonstration	Evaluation through: quiz, Assignments Formative assessment
	2	Meissner effect-effect of current- thermal properties- entropy-specific heat -energy gap - isotope effect	3	To discuss Meissner effect	Lecture-cum-discussion, Demonstration	
	3	London equations - AC & DC Josephson effects -	3	To understand the London equations	Lecture-cum-discussion,	

		applications-			Demonstration	
	4	Type–I and Type–II Superconductors - Explanation for the Occurrence of Super Conductivity - BCS theory - Application of Superconductors - High T_C superconductors.	3	To discuss the Type–I and Type–II Superconductors and application of Superconductors	Lecture-cum-discussion, Demonstration	

CO-Course Outcome; CL-Cognitive Level; R- Remember; U- Understand; Ap-Apply; An-Analyze; C - Create.

Course Instructors: Dr. C.Nirmala Louis & Dr. V.Shally