Holy Cross College (Autonomous), Nagercoil

Kanyakumari District, Tamil Nadu.
Accredited with A^{++} by NAAC - V Cycle (CGPA 3.53)

Affiliated to
Manonmaniam Sundaranar University, Tirunelveli

Semester I - VI

UG Guidelines & Syllabus

DEPARTMENT OF PHYSICS

2023-2026
(With effect from the academic year 2025-2026)

Teaching Plan (UG)
Even Semster
2025-2026

Vision

Envisions training students for quality Physics education and holistic development empowered to meet challenges and embark on luxuriant careers.

Mission

- To produce competent graduates infused with professionalism, ethical values and social responsibility.
- To prepare students to accentuate learning for life.
- To foster a research environment, to keep up with global development in Science.
- To evolve strategies for the growth of the department towards excellence.

Graduate Attributes

Graduates of our College develop the following attributes during the course of their studies.

- **Creative thinking:**

Equipping students with hands-on-training through skill-based courses and promote startup.

- **Personality development:**

Coping with increasing pace and change of modern life through value education, awareness on human rights, gender issues and giving counselling for the needful.

- **Environmental consciousness and social understanding:**

Reflecting upon green initiatives and understanding the responsibility to contribute to the society; promoting social and cultural diversity through student training and service-learning programmes.

- **Communicative competence:**

Offering effective communication skills in both professional and social contexts through bridge courses and activities of clubs and committees.

- **Aesthetic skills:**

Engaging mind, body and emotions for transformation through fine arts, meditation and exercise; enriching skills through certificate courses offered by Holy Cross Academy.

- **Research and knowledge enrichment:**

Getting in-depth knowledge in the specific area of study through relevant core papers; ability to create new understanding through the process of critical analysis and problem solving.

- **Professional ethics:**

Valuing honesty, fairness, respect, compassion and professional ethics among students. The students of social work adhere to the *National Association of Social Workers Code of Ethics*

- **Student engagement in the learning process:**

Obtaining extensive and varied opportunities to utilize and build upon the theoretical and empirical knowledge gained through workshops, seminars, conferences, industrial visits and summer internship programmes.

- **Employability:**

Enhancing students in their professional life through Entrepreneur development, Placement & Career guidance Cell.

- **Women empowerment and leadership:**

Developing the capacity of self-management, team work, leadership and decision making through gender sensitization programmes.

Programme Educational Objectives (PEOs)

PEOs	Upon completion of B.A/B.Sc. degree programme, the graduates will be able to	Mission addressed
PEO1	apply appropriate theory and scientific knowledge to participate in activities that support humanity and economic development nationally and globally, developing as leaders in their fields of expertise.	M1 & M2

PEO2	inculcate practical knowledge for developing professional empowerment and entrepreneurship and societal services.	**M2, M3, M4 & M5**
PEO3	pursue lifelong learning and continuous improvement of the knowledge and skills with the highest professional and ethical standards.	**M3, M4, M5 & M6**

Programme Outcomes (POs)

POs	**Upon completion of B.Sc. Degree Programme, the graduates will be able to:**	**Mapping with PEOs**
PO1	obtain comprehensive knowledge and skills to pursue higher studies in the relevant field of science.	**PEO1**
PO2	create innovative ideas to enhance entrepreneurial skills for economic independence.	**PEO2**
PO3	reflect upon green initiatives and take responsible steps to build a sustainable environment.	**PEO2**
PO4	enhance leadership qualities, team spirit and communication skills to face challenging competitive examinations for a better developmental career.	**PEO1 & PEO3**
PO5	communicate effectively and collaborate successfully with peers to become competent professionals.	**PEO2 & PEO3**
PO6	absorb ethical, moral and social values in personal and social life leading to highly cultured and civilized personality	**PEO2 & PEO3**
PO7	participate in learning activities throughout life, through self-paced and self-directed learning to improve knowledge and skills.	**PEO1 & PEO3**

Programme Specific Outcome (PSOs)

PSOs	**Upon completion of B.Sc. Physics Degree Programme, the graduates of Physics will be able to:**	**Mapping with POs**
PSO1	understand the core theories and principles of physics which include mechanics, thermodynamics, electronics, material science etc.	**PO1**
PSO2	develop extensive comprehension of fundamental and diverse applications of Physics.	**PO2 & PO3**
PSO3	apply knowledge of principles, concepts in Physics and analyze their local, national and global impact. Apply the critical reasoning and computing skills to analyze and solve problems in physics.	**PO4 & PO5**
PSO4	analyze the observed experimental data and relate the results with theoretical expectations. Communicate appropriately and effectively, in a scientific context using present technology.	**PO6**
PSO5	develop entrepreneurial skills, empowered according to the professional requirement and become self-dependent. Understand the professional, ethical, legal, security, social issues and responsibilities.	**PO5 & PO7**

Teaching Plan

Department : Physics
Class : I B.Sc. Physics
Title of the Course : Core Course –II: Heat, Thermodynamics and Statistical Physics
Semester I
Course Code : PU232CC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU232CC1	5	-	-	-	5	5	75	25	75	100

Learning Objectives:

1. To understand a basic in conversion of temperature in Celsius, Kelvin and Fahrenheit scales.
2. To Relate the laws of thermodynamics, entropy in everyday life and explore the knowledge of statistical mechanics and its relation

Course Outcomes

On the successful completion of the course, students will be able to**:**		
1.	acquires knowledge on how to distinguish between temperature and heat, and explain practical measurements of high temperature as well as low temperature physics.	**K1 & K2**
2.	derive the efficiency of Carnot's engine and discuss the implications of the laws of Thermodynamics in diesel and petrol engines	**K1 & K3**
3.	analyze performance of thermodynamic systems viz efficiency by problems and gets an insight into thermodynamic properties like enthalpy, entropy	**K2 & K3**
4.	study the process of thermal conductivity and apply it to good and bad conductors.	**K2 & K3**
5.	interpret classical statistics concepts such as phase space, ensemble, Maxwell-Boltzmann distribution law, Bose-Einstein and Fermi-Dirac .	**K2 & K3**

Teaching Plan

Total Contact Hours: 75 (Including Lectures, Assignments and Tests)

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation
I	**Calorimetry and Low Temperature Physics**								
	1.	Specific heat capacity – specific heat capacity of gases C_P & C_V– Meyer's relation	3	2	K1 (R)	Concept-based derivation and demonstration	Think–Pair–Share, group derivation	YouTube – lectures on Specific Heat Capacity	MCQ quiz, Group Presentation, CIA 1
	2.	Joly's method for determination of C_V –	2		K2 (U)	Demonstration of calorimetric methods	Virtual lab, peer discussion	YouTube experiments, virtual	Oral Questions on elastic

		Regnault's method for determination of C_P						calorimeter	constants, CIA 1
	3.	Joule-Kelvin effect – porous plug experiment – Joule-Thomson effect	3		K2 (U)	Animated explanation of JT effect	Group reasoning, diagram analysis	NPTEL JT effect videos	Derivation-based quiz, concept map CIA 1
	4.	Boyle temperature – temperature of inversion – liquefaction of gas by Linde's Process – adiabatic demagnetisation.	4	1	K2 (U)	Diagram-based teaching of cooling methods	Group project, peer teaching	Linde plant simulations	Numerical problems, CIA 1
II	**Thermodynamics-I**								
	1.	Zeroth law and first law of thermodynamics	2	2	K1 (R)	Explanation with real thermodynamic systems	Inquiry-based learning	MIT OCW thermodynamics	Quiz & problem sheet, CIA 1
	2.	P-V diagram – heat engine –efficiency of heat engine	3		K3 (Ap)	P–V diagram analysis	Collaborative problem-solving	PhET simulations	Numerical assessment, CIA 1
	3.	Carnot's engine, construction, working	3	1	K3 (Ap)	Working model explanation	Group role-play of engine cycle	Engine animations	Cycle-based numericals, CIA 1
	4.	efficiency of petrol engine and diesel engines – comparison of engines	4		K3 (Ap)	Comparative teaching with charts	Group comparison tasks	Automotive thermodynamics videos	Comparison chart evaluation, CIA 1
III	**Thermodynamics-II**								
	1.	Second law of thermodynamics - entropy of an ideal gas – entropy change in reversible and irreversible processes	4	2	K3 (Ap)	Concept teaching with entropy diagrams	Think–Pair–Share	Entropy animations	Long answer & numerical, CIA I
	2.	T-S diagram – thermodynamical scale of temperature	2		K3 (Ap)	Diagrammatic method	Student-drawn T–S diagrams	Thermo simulations	Diagram evaluation, CIA I
	3.	Maxwell's thermodynamical relations – Clasius-Clapeyron's equation (first latent heat equation)	3		K2 (U)	Derivation-driven teaching	Collaborative derivation	NPTEL Maxwell relations	Derivation test, CIA II

	4.	Third law of thermodynamics – unattainability of absolute zero – heat death.	3	1	K3 (Ap)	Discussion-oriented	Student seminar	Third law videos	Seminar assessment, CIA II
IV	**Heat Transfer**								
	1.	Modes of heat transfer: conduction, convection and radiation	2	2	K2 (U)	Visualization of heat transfer	Group experiment with materials	Heat transfer animations	Written Test, Practical assessment, CIA II
	2.	Thermal conductivity – determination of thermal conductivity of a good conductor by Forbe's method – determination of thermal conductivity of a bad conductor by Lee's disc method.	4		K2 (U)	Experimental demonstration	Hands-on virtual lab	Thermal conductivity virtual lab	Lab performance evaluation, CIA II
	3.	Radiation: black body radiation (Ferry's method) – distribution of energy in black body radiation – Wien's law and Rayleigh Jean's law	3	1	K3 (Ap)	Graphical teaching	Data plotting activity	Black body simulation tools	Graph evaluation, CIA II
	4.	Planck's law of radiation – Stefan's law – deduction of Newton's law of cooling from Stefan's law.	3		K3 (Ap)	Derivation-based lecture	Collaborative derivation	Radiation law videos	Written test, CIA II
V	**Statistical Mechanics**								
	1.	Definition of phase-space – micro and macro states – ensembles –different types of ensembles	3	2	K2 (U)	Conceptual discussion	Group examples	Phase space animations	Short-answer test, CIA II
	2.	Classical and quantum Statistics – Maxwell Boltzmann statistics – expression for distribution function	3		K3 (Ap)	Derivation & examples	Problem-solving	Stat mech lectures	Numerical evaluation, CIA II
	3.	Bose-Einstein statistics – expression for distribution function	2	1	K2 (U)	Concept explanation	Collaborative analysis	BE statistics videos	Descriptive test, CIA II

	4.	Fermi-Dirac statistics – expression for distribution function – comparison of three statistics.	4		K3 (Ap)	Comparative teaching	Student presentation	FD statistics tools	Presentation assessment, CIA II

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

Course Focussing on Employability/ Entrepreneurship/ Skill Development : Skill Development

Activities (SD): Hands on training on modes of heat transfer.

Course Focussing on Cross Cutting Issues(Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): -

Activities related to Cross Cutting Issues :-

Assignment : Heat engines.

Sample Questions

Part A

1. _____is the unit of specific heat capacity. **(K1 - R, CO - 1)**
2. _____law defines the term temperature. **(K1 - R, CO - 2)**
3. State True / False. Absolute zero temperature can be easily attained. **(K2 - U, CO - 3)**
4. Define temperature gradient. **(K2 - U, CO - 4)**
5. Ensembles are classified into _____types. **(K1 - R, CO - 5)**

Part B

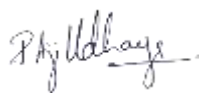
1. Write a short note on adiabatic demagnetisation. **(K1 - R, CO - 1)**
2. Calculate the efficiency of Carnot's engine working between the temperatures 227ºC and 15ºC. **(K3- Ap, CO -2)**
3. Derive Claussius latent heat equation. **(K3- Ap, CO -3)**
4. State and explain laws relating to black body radiation and bring out characteristics of black body radiations. **(K2- U, CO -4)**
5. Distinguish between Maxwell – Boltzmann, Fermi – Dirac and Bose – Einstein statistics. **(K2- U, CO -5)**

Part C

1. Derive Meyer's relation for the two specific capacity of a gas. **(K2- U, CO -1)**
2. Explain the construction and working of Otto engine. **(K2- U, CO -2)**
3. Derive Maxwell's thermodynamic relations. **(K2- U, CO -3)**
4. Explain Lee's method of determining the thermal conductivity of a bad conductor. **(K2- U, CO -4)**
5. Obtain the expression for Fermi – Dirac distribution law. Using it, derive expression for the Fermi energy of an electron in a metal. **(K3- Ap, CO -1)**

Dr. V. Shally

Head of the Department



Dr. P. Aji Udhaya

Course Instructor

Teaching Plan

Department : Physics
Class : I B.Sc. Physics
Title of the Course : CORE LAB COURSE VI: GENERAL PHYSICS LAB II
Semester : II
Course Code : PU232CP1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU232CP1	-	-	3	-	3	3	45	25	75	100

Learning Objectives:

1. To apply their knowledge gained about the concept of heat and sound waves, resonance.
2. To do error analysis and correlate results

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	understand the strength of materials using physical experiments.	**K2**
2.	acquire knowledge of thermal behaviour of the materials.	**K1**
3.	analyze the physical principle involved in the various instruments such as sonometer and Melde's String.	**K4**
4.	understand the scientific method and an ability to apply the scientific method in practice.	**K2**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze

Total Contact hours: 30 (Including Practical Classes and Assessments)

Unit	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
1	Newton's law of cooling	6	1	K1& K2	Experiential Learning	Hands-on experiment, peer observation	YouTube lab demos, virtual lab	Observation record, viva, Result, calculation
2	Specific heat by cooling – graphical method.	7		K1& K2	Inquiry-Based Learning	Formulating hypotheses, exploring outcomes	NPTEL lab videos	Lab report, error analysis, oral quiz
3	Lee's disc method - Thermal conductivity of bad conductor	7	1	K1& K2	Problem-Based Learning	Solving based on changing parameters, peer discussion	YouTube lab demos	Viva, graphical analysis, performance rubric
4	Sonometer - Frequency of AC	6	1	K1& K2	Project-Based Learning	Team setup of apparatus, recording trials	Virtual experiment videos	Lab report, collaborative worksheet, viva voce
5	Melde's apparatus – verification of the laws of transverse vibration	7	1	K2& K4	Active Learning	Live demonstration, pauseand-predict questions	Interactive animations	Short quiz, precision in result, lab notes

6	Compound pendulum determination of g	7	1		Blended Learning	Hybrid: prelab video, physical lab, peer timing validation	Pre-lab NPTEL video	Performance evaluation, lab record, post-lab quiz

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Employability, Skill Development

Activities (Em / En /SD): Hands on Training

Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): NIL

Environment Sustainability activities related to Cross Cutting Issues: NIL

Sample questions

1. Verify Newton's law of cooling using spherical calorimeter.
2. Determine the specific heat capacity of the given liquid by cooling method.
3. Determine the coefficient of thermal conductivity of the given bad conductor by lee's disc method.
4. Find the acceleration due to gravity at a place using compound pendulum.
5. Determine the frequency of A.C mains using sonometer.
6. Determination of frequency of an electrically maintained tuning fork

Dr. V. Shally

Head of the Department

Dr. A. Lesly Fathima & Dr. P. Aji Udhaya

Course Instructor

Teaching Plan

Department : Physics
Class : I B.Sc Mathematics
Title of the Course : ELECTIVE COURSE–II: ALLIED PHYSICS FOR MATHEMATICS – II
Semester : II
Course Code : PU232EC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU232EC1	4		-		3	4	60	25	75	100

Learning Objectives:

1. To impart basic principles of Physics
2. To incorporate concepts of Physics in day to day life

Course Outcomes

On the successful completion of the course, student will be able to:		
CO1	explain the concepts of interference, diffraction and rephrase the concept of polarization	**K1 & K2**
CO2	outline the basic foundation of different atom models and relate the importance of theoretical models	**K1 & K2**
CO3	understand the properties of nuclei, nuclear forces, structure of atomic nucleus and nuclear models and interpret nuclear processes like fission and fusion.	**K2& K3**
CO4	describe the basic concepts of relativity like equivalence principle, inertial frames and Lorentz transformation.	**K3 & K4**
CO5	summarize the working of semiconductor devices like diodes, transistors, USB chargers and EV charging stations.	**K4& K5**

Teaching plan

Total Contact hours: 60 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	Reference Books	E-resources	Assessment/ Evaluation
I	1.	Interference – interference in thin films – colors of thin films	2	1	K1(R)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping,	Brainstroming, Discussion of experiences , group activities	Murugesan R (2001), Allied Physics, S.Chand & Co, New Delhi	Video Lectures, Interactive notes	Conceptual Quiz, Formative worksheet, Peer discussion, CIA-I
	2.	air wedge – determination of diameter of a thin wire by air wedge	2		K1 (R)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	Formulating questions, solving challenges and puzzles		Desmos, Interactive PPT, Youtube videos	Problem-Solving Assignments, Open Book Exam, short oral test, CIA-I
	3.	Diffraction – diffraction of light vs sound – normal incidence	1	1	K2(U)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping	Think-pair-share, group activities and puzzles		Physics libre texts, youtube visual models	Matching exercises, diagram based MCQs, CIA-I
	4.	experimental determination of wavelength using diffraction grating (no theory)	1		K2(U)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	Think-pair-share, group activities		Physics libre texts, youtube visual models	Matching exercises, diagram based MCQs, CIA-I

	5.	polarization - polarization by double reflection	1	1		Reflective pedagogical approach, peer teaching	Group discussion and activities, debates		Lab Videos, Libre texts, Interactive PPT	Oral quiz, activity worksheet, conceptual MCQ, CIA-I
	6.	Brewster's law – optical activity – application in sugar industries	2			Application-Oriented Learning, Analytical Learning	Assign pre-class video viewing and in-class problem-solving		Youtube lecture videos, Interactive PPT	Oral quiz, activity worksheet, conceptual MCQ, CIA-I
II	1.	Atom models – Bohr atom model – mass number – atomic number – nucleons	2	1	K1(R)	Concept Mapping, experiential learning, reflective approach	Think-Pair-Share, working through problems	Murugesan R (2001), Allied Physics, S.Chand & Co, New Delhi	YouTube lecture videos, physics galaxy channel, libre text	Assignment, conceptual MCQs, table analysis task, CIA-I
	2.	vector atom model - various quantum numbers - Pauli's exclusion principle	2		K2(U)	Inquiry based learning, peer teaching	Lab Analysis		Video Lecture	rmative Quiz using Nearpod / Kahoot / Google Forms, CIA I
	3.	electronic configuration – periodic classification of elements	1	1	K2 (U)	Active learning, Flipped classroom	Brainstorming , Group discussions		*Video Lectures,* Simulations, web tools	Formative Quiz using Google Forms, CIA I
	4.	Bohr magneton - Stark effect – Zeeman effect (elementary ideas only)	1		K1(R)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping	Think-Pair-Share, Concept Mapping		Youtube lecture videos, Interactive PPT	Assignment, conceptual MCQs, short test, CIA-I
	5.	photo electric effect - Einstein's photoelectric equation	1	1	K1(R)	Peer tutoring, Lecture using videos, Problem solving, Derivation , PPT, Review	Peer teaching , Quiz, Explaining concepts and derivations		Interactive Notes, Online Tutorials and Notes: HyperPhysics	Problem-Solving Assignments, Open Book Exam Questions, CIA I

	6.	applications of photoelectric effect: solar cells, solar panels, optoelectric devices	2		K2(U)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping,	Think -Pair-Share, hands on experiments		NPTEL Lectures, Khan Academy Physics – Conceptual videos	Conceptual MCQ, Peer discussions and concept maps, CIA-I

III	1.	Nuclear models – liquid drop model – magic numbers – shell model – nuclear energy – mass defect	2	1	K2(U)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping,	Animation-based learning, Think-pair-share	Ubald Raj.A and Jose Robin G. 2012, Allied Physics, Indira Publications, marthandam	HyperPhysics, NPTEL lectures	Peer-assessed derivation, conceptual quiz, CIA-I
	2.	binding energy – radioactivity – uses – half life – mean life - radio isotopes and uses	2		K2(U)	Diagram-Based, reflective pedagogical approac	Group Presentation, peer feedback on reflective practices		Thermo Simulators, Youtube video lectures	Problem-Solving Assignments, Open Book Exam Questions, CIA I
	3.	controlled and uncontrolled chain reaction – nuclear fission – energy released in fission	1	1	K2(U)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT	Animation-based learning, Think-pair-share		HyperPhysics, NPTEL lectures	Peer-assessed derivation, conceptual quiz, CIA-I
	4.	chain reaction – critical reaction – critical size-atom bomb – nuclear reactor	1		K2 (U)	Conceptual Demonstration, Flipped Classroom	Peer Teaching, Gamified Quiz, Concept Mapping.		NPTEL Lectures, Khan Academy Physics – Conceptual videos	Formative Quiz using Google Forms, CIA II

	5.	Breeder reactor – importance of commissioning PFBR in our country – heavy water disposal, safety of reactors: seismic and floods	2	1	K3(Ap)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping,	Animation-based learning, Think-pair-share		HyperPhysics, NPTEL lectures	Conceptual MCQ, Peer discussions and concept maps, CIA-II
	6.	introduction to DAE, IAEA – nuclear fusion – thermonuclear reactions – differences between fission and fusion.	1		K3(Ap)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	Group Presentation, peer feedback on reflective practices		Thermo Simulators, Youtube video lectures	Assignment, conceptual MCQs, short test, CIA II
IV	1.	Frame of reference – postulates of special theory of relativity	2	1	K3(Ap)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping	Assign pre-class video viewing and in-class problem-solving	Ubald Raj.A and Jose Robin G. 2012, Allied Physics, Indira Publications, marthandam	Youtube lecture videos, Interactive PPT	Evaluation through: short Class Test, Oral quiz, CIA II
	2.	Galilean transformation equations - Lorentz transformation equations	2		K3 (Ap)	Concept Mapping, experiential learning, reflective approach	Think-Pair-Share, working through problems		YouTube lecture videos, physics galaxy channel, libre text	Assignment, conceptual MCQs, table analysis task, CIA-II
	3.	derivation – length contraction – time dilation	1	1	K3 (Ap)	Peer tutoring, Lecture using videos, Problem solving, Derivation, PPT	Brainstorming , Group discussions		*Video Lectures,* Simulations, web tools	Formative Quiz using Google Forms, CIA II

	4.	twin paradox – mass-energy equivalence – introduction on gravitational waves	2	1	K4(An)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping,	Think-Pair-Share, Concept Mapping		Youtube lecture videos, Interactive PPT	Assignment, conceptual MCQs, short test, CIA-II
	5.	LIGO, ICTS opportunities at International Centre for Theoretical Sciences	2		K4(An)	Peer tutoring, Lecture using videos, Problem solving, Derivation, PPT, Review	Peer Teaching, Gamified Quiz, Concept Mapping.		NPTEL Lectures, Khan Academy Physics – Conceptual videos	Poster/chart Presentation, Short-answer conceptual questions, CIA II
V	1.	p-n junction diode – forward and reverse biasing	2	1	K4(An)	Lecture using Chalk and talk , Introductory session, Group Discussion, Derivation	Debate, answering questions from peers	Ubald Raj.A and Jose Robin G. 2012, Allied Physics, Indira Publications, marthandam	HyperPhysics, Visual and animated tutorials	Quick quizzes - Concept check MCQs, CIA-II
	2.	characteristic of diode – zener diode	1		K4 (An)	Inquiry-Based Learning, Visual/Graphical Pedagogy	Animation-based learning, Think-pair-share		HyperPhysics, NPTEL lectures	Peer-assessed derivation, conceptual quiz, CIA-II

	3.	characteristic of zener diode – voltage regulator	2	1	K4(An)	Peer tutoring, Lecture using videos, Problem solving, PPT,	Peer Teaching, Gamified Quiz, Concept Mapping.		NPTEL Lectures, Khan Academy Physics – Conceptual videos	Poster/chart Presentation, Short-answer conceptual questions, CIA II
	4.	full wave bridge rectifier - construction and working – advantages (no mathematical treatment)	2	1	K5(E)	Lecture using Chalk and talk ,Derivation, Group Discussion, Mind mapping,	Think-pair-share, group activities		Physics libre texts, youtube visual models	Matching exercises, diagram based MCQs, CIA-II
	5.	USB cell phone charger - introduction to e- vehicles and EV charging stations	2		K5(E)	Peer tutoring, Lecture using videos, Problem solving, PPT	Group discussion and activities, debates	Government sites	Lab Videos, Libre texts, Interactive PPT	Oral quiz, activity worksheet, conceptual MCQ, CIA-II

Course Focussing on Employability/ Entrepreneurship/ Skill Development : **Skill Development**

Activities (Em/ En/SD): Display on IC collection

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): - Environment Sustainability Activities related to Cross Cutting Issues : - Assignment : introduction to e-vehicles and EV charging stations (IC 7483) Seminar Topic: ICTS opportunities at International Centre for Theoretical Sciences

Sample questions Part A

1. Double refraction does not take place. **(K1-R, CO-1)**
   a) in quartz b)in calcite c)in water d) none of the above

2. Atomic radius is the ---------- distance from the nucleus of an atom to the outermost orbit. **(K2-U, CO-2)**
   (a) half (b) mean (c) total d) None

3. Nuclei having same mass number are named as _____**(K2- U, CO-3)**
   (a) isotopes (b) isobars (c) isotones (d) isomer

4. All the accelerated frames are inertial frames of reference. TRUE/FALSE **(K4- An, CO 4)**
5. The emitter current is the sum of the base current and the collector current. True / False.

   (K4- An, CO-5)

Part B

1. State and devise Bragg's law. **(K2- U, CO-1)**

2. Explain the significance of vector atom model. **(K2-U, CO-2).**

3. Distinguish between nuclear fission and nuclear fusion. **(K2-U, CO-3)**

4. Obtain the Lorentz transformation equations. **(K3-Ap, CO-4)**
5. How the zener diode acts as a voltage regulator? Explain. **(K4-An, CO-5)**

Part C

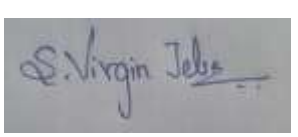
1. Derive the expression for the fringe width. Give the experimental procedure to measure the diameter of thin wire using Air wedge. **(K2-U, CO-1)**

2. Explain about atomic radius and calculate the radius and energy of the electron in the nth orbit in hydrogen atom. **(K2-U, CO-2)**

3. Give a detailed account on the properties of nucleus. **(K3- Ap, CO-3)**

4. Obtain the Galilean transformation equations. **(K4- An, CO -4)**
5. Construct the Bridge Rectifier and explain the working principle**.(K6-C,CO-5)**

Dr. V. Shally
Head of the Department



Dr. S. Virgin Jeba
Course Instructor

Teaching Plan

Department : Physics
Class : I B.Sc. Mathematics
Title of the Course : Elective Course: Allied Physics Practical for Mathematics – II
Semester : II
Course Code : PU232ECP1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
PU232EP1	-	-	2	-	2	2	30	CIA	External	Total
								25	75	100

Prerequisites:
Basic Knowledge in physics experiments

Learning Objectives:

1. To apply various Physics concepts to understand concepts of Light, electricity and magnetism and waves, set up experimentation to verify theories, quantify and analyze,
2. To able to do error analysis and correlate results

Course Outcomes

On the successful completion of the course, student will be able to:		
1	understand the nature of monochromatic light and its diffraction and interference phenomenon	**K2**
2	design simple logic circuits	**K3**
3	analyze the physical principle involved in the various instruments	**K4**
4	understand the scientific method and an ability to apply the scientific method in practice.	**K2**

K2 – Understand; **K3** - Apply; **K4** - Analyze

Total Contact hours: 30 (Including Practical Classes and Assessments)

Unit	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
1	Radius of curvature of lens by forming Newton's rings	4	1	K2	Inquiry-Based Learning, Project-Based Learning	Real world application of skills, Peer Learning through group tasks	Virtual labs by MHRD vlab.co.in	concept explanation, teamwork, result accuracy, Model Exam
2	Thickness of a wire using air wedge	4	1	K3	Peer Teaching, Reciprocal Learning, Reciprocal method	Group Activity, Think-Aloud Protocol	Amrita virtual labs amritavlab.amrita.edu	Project based Evaluation, result accuracy, Model Exam
3	Refractive index of material of the lens by minimum deviation	4	1	K2	Blended Learning, Demonstration method	Hands-on circuit construction and real-time experimentation		Oral Q&A ,Troubleshooting questions, circuit construction, Model Exam
4	Thermal conductivity of poor conductor using Lee's disc	4	1	K3	Constructivist Pedagogy, Activity-Based Learning	Peer Teaching (exchanging roles during circuit building), Think-Pair-Share (for truth table generation and circuit design)	Physics galaxy Youtube channel, Lab manuals	Result accuracy, Lab report with calculation, team work
5	Characterization of Zener diode	5	1	K4	Experiential Learning, Inquiry-Based Pedagogy	Lab work, Peer Learning through group tasks	NPTEL nptel.ac.in, Amrita virtual labs amritavlab.amrita.edu	Concept-based oral questions, Lab report with calculated vs observed values, Peer evaluation on troubleshooti

								ng skills, Model Exam
6	Construction of AND, OR, NOT gates using diodes and transistor	4	1	K3	Project-Based Learning, Problem-Based Learning	Peer Teaching (exchanging roles during circuit building), Think-Pair-Share (for truth table generation and circuit design)	Learn engineering Youtube channel	Viva on truth table, logic equations, Circuit functionality test, Model Exam.

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Employability, Skill Development

Activities (Em / En /SD): Hands on Training , Project

Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): NIL

Environment Sustainability activities related to Cross Cutting Issues: NIL

Sample Questions

1. Find the refractive index of the material of the lens, assuming the wavelength of the monochromatic light from sodium vapor lamp ($\lambda = 5893 \times 10^{-10}$ m) by Newton's Rings method.
2. Determine the thickness of the given thin wire by forming an interference fringe pattern using an air wedge setup ($\lambda = 5893 \times 10^{-10}$ m).
3. Determine the coefficient of thermal conductivity of the given bad conductor by lees disc method.
4. Construct Zener Diode in Forward and Reverse bias. Draw Voltage- Ampere characteristics of Zener diode.
5. Determine the refractive index of the prism by minimum deviation.
6. Construct the basic logic gates OR, AND and NOT using Transistor and diode. Verify their truth tables.

Dr.V.Shelly
Head & Associate Professor
Department of Physics
Holy Cross College (Autonomous)

Head of the department

Dr. S. Virgin Jeba & **Dr.Sr. Sebastiammal**

Course Instructor

Teaching Plan

Department : Physics
Title of the Course : Non Major Elective: Physics of Music
Semester : II
Course Code : PU232NM1

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
PU232NM1	2		-	2	2	30	25	75	100

Pre-requisite:
Students should know about the basic knowledge regarding sound, vibrating systems and musical instruments.

Learning Objectives:
1. To educate and instruct students on the significance of physics in music.
2. To gain understanding of musical notes and instruments.

Course Outcomes

On the successful completion of the course, student will be able to**:**		
1.	understand the principles and basic scientific concepts in sound waves	**K2**
2.	understand the various phenomena of simple vibrating systems.	**K1**
3.	comprehend the various musical notes and its production	**K2**
4.	apply the knowledge of recording music in day to day life activities.	**K3**
5.	know the scientific concepts of music	**K2**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Teaching plan

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

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	Reference Books	E-resources	Assessment/ Evaluation
I	1.	vibrations of atoms of matter– vibrations coupling to air	1	1	K2(U)	Lecture using Chalk and talk ,Introductory session,	Brainstroming, Discussion of experiences	Harvey White (2004), Physics and music: The science of musical sound, Dover Publications Inc, New York	Video Lectures, Interactive notes	Conceptual Quiz, Formative worksheet, CIA-I
	2.	propagation of sound waves in air, other media, fluids & solids	1		K2 (U)	Peer tutoring, Lecture using videos, PPT	Formulating questions		Desmos, Interactive PPT, Youtube videos	Open Book Exam, short oral test, CIA-I
	3.	velocity, frequency, wavelength, time period, intensity: definition and unit fs	1		K2(U)	Lecture using Chalk and talk , Mind mapping	Think-pair-share, group activities		Physics libre texts, youtube visual models	Matching exercises, diagram based MCQs, CIA-I
	4.	classification of sound on frequency and velocity	1		K2(U)	Peer tutoring, Lecture using videos,	Think-pair-share, group activities		Physics libre texts, youtube visual models	Matching exercises, diagram based MCQs, CIA-I
	5.	human & animal sound perception mechanism of ear and hearing – psychoacoustics	1		K2(U)	Reflective pedagogical approach, peer teaching	Group discussion and activities, debates		Lab Videos, Libre texts, Interactive PPT	Oral quiz, activity worksheet, CIA-I

II	1.	Simple harmonic motion – tuning fork	1	1	K2(U)	Concept Mapping, experiential learning, reflective approach	Think-Pair-Share, working through problems	UU Harvey White (2004), Physics and music: The science of musical sound, Dover Publications Inc, New York	YouTube lecture videos, physics galaxy channel, libre text	conceptual MCQs, table analysis task, CIA-I
	2.	amplitude, phase, energy, energy loss/damping/ dissipation – power	1		K2(U)	Inquiry based learning, peer teaching	Lab Analysis		Video Lecture	Formative Quiz using Nearpod / Kahoot / Google Forms, CIA I
	3.	travelling waves and standing waves- laws of vibration in stretched strings	1		K2 (U)	Active learning, Flipped classroom	Brainstorming , Group discussions		*Video Lectures,* Simulations, web tools	Formative Quiz using Google Forms, CIA I
	4.	one-dimensional medium – open and closed organ pipes	1		K2(U)	Lecture using Chalk and talk , Group Discussio n, Mind mapping	Think-Pair-Share, Concept Mapping		Youtube lecture videos, Interactive PPT	Assignment, conceptual MCQs, short test, CIA-I
	5.	over tones, harmonics, quality of sound: pitch, timber, loudness – octaves, musical notes	1		K2(U)	Peer tutoring, Lecture using videos, Derivation , PPT, Review	Peer teaching , Quiz, Explaining concepts and derivations		Interactive Notes, Online Tutorials and Notes: HyperPhysics	Open Book Exam Questions, CIA I

III	1.	pure/simple tones – sine/cosine waves– well-defined frequencies, wavelengths, amplitudes & phases	1	1	K2(U)	Lecture using Chalk and talk ,Introduct ory session, Group Discussio n, Mind mapping,	Animation-based learning, Think-pair-share	Harvey White (2004), Physics and music: The science of musical sound, Dover Publications Inc, New York	HyperPhysics, NPTEL lectures	Peer-assessed derivation, conceptual quiz, CIA-I Problem-

	2.	partial tones – assembly of pure tones– mix of different frequencies & amplitudes	1		K2(U)	Diagram-Based, reflective pedagogical approac	Group Presentation, peer feedback on reflective practices		Thermo Simulators, Youtube video lectures	Solving Assignments, Open Book Exam Questions, CIA I Peer-assessed derivation, conceptual quiz, CIA-I Formative Quiz using Google Forms, CIA II
	3.	complex tone – superposition of simple tones	1		K2(U)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT	Animation-based learning, Think-pair-share		HyperPhysics, NPTEL lectures	
	4.	complex waveform– periodic complex waveform	1		K2 (U)	Conceptual Demonstration, Flipped Classroom	Peer Teaching, Gamified Quiz, Concept Mapping.		NPTEL Lectures, Khan Academy Physics – Conceptual videos	

	5.	formants – resonances– sound envelope	1		K2(U)	Lecture using Chalk and talk , Group Discussio n, Mind mapping	Animation-based learning, Think-pair-share		HyperPhysics, NPTEL lectures	
IV	1.	human voice,mechani sm of vocal sound production – larynx (sound box)	1	1	K2(U)	Lecture using Chalk and talk , Group Discussion , Mind mapping	Assign pre-class video viewing and	Harvey White (2004), Physics and music: The science of musical sound, Dover Publications Inc, New York	Youtube lecture videos, Interactive PPT	Evaluation through: short Class Test, Oral quiz, CIA II
	2.	stringed Instruments:pl ucked &bowed, guitar, mandolin, violin, piano, etc.	1		K2 (U))	Concept Mapping, experiential learning, reflective approach	Think-Pair-Share, working through problems		physics galaxy channel, libre text	Assignment, conceptual MCQs, table analysis task, CIA-II
	3.	wind instruments: whistles, flute, saxophone, pipe organ, bag pipes,etc	1		K2 (U)	Peer tutoring, Lecture using videos,	Brainstorming , Group discussions		*Video Lectures,* Simulations, web tools	Formative Quiz using Google Forms, CIA II
	4.	percussion instruments, electronic instruments	1		K2(U)	Lecture using Chalk and talk Mind mapping	Think-Pair-Share, Concept Mapping		Youtube lecture videos, Interactive PPT	Assignment, conceptual MCQs, short test, CIA-II
	5.	analog and digital sound synthesizers	1		K2(U)	Peer tutoring, Lecture using videos, PPT, Review	Peer Teaching, Gamified Quiz, Concept Mapping.		Academy Physics – Conceptual videos	Poster/chart Presentation, Short-answer conceptual questions, CIA II

V	1.	Edison phonograph – cylinder & disk records	1	1	K1(R)	Lecture using Chalk and talk , Group Discussion, Derivation	Debate, answering questions from peers	Harvey White (2004), Physics and music: The science of musical sound, Dover Publications Inc, New York	HyperPhysics, Visual and animated tutorials	Quick quizzes - Concept check MCQs, CIA-II
	2.	magnetic wire and tape recorders – digital recording	1		K1 (R)	Inquiry-Based Learning, Visual/Graphical Pedagogy	Animation-based learning, Think-pair-share		HyperPhysics, NPTEL lectures	Peer-assessed conceptual quiz, CIA-II
	3.	analog transducers, condenser, dynamic microphones	1		K1(R)	Peer tutoring, Lecture using videos,	Peer Teaching, Gamified Quiz, Concept Mapping.		Physics – Conceptual videos	Short-answer conceptual questions, CIA II
	4.	loudspeaker – complex sound fields- digital signal processing	1		K1(R)	Lecture using Chalk and talk ,Derivation	Think-pair-share, group activities		Physics libre texts, youtube visual models	Matching exercises, diagram based MCQs, CIA-II
	5.	digital filtering – specifications of recording studios	1		K1(R)	Peer tutoring, Lecture using videos, PPT	Group discussion and activities, debates		Interactive PPT	Oral quiz, activity, CIA-II

Course Focussing on Employability/ Entrepreneurship/ Skill Development : **Skill Development**

Activities (Em/ En/SD): Display on IC collection

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): - Environment Sustainability

Activities related to Cross Cutting Issues : -

Assignment : introduction to e-vehicles and EV charging stations (IC 7483) Seminar Topic:

ICTS opportunities at International Centre for Theoretical Sciences

Sample questions

Part A (1 mark)

1. Frequency and wavelength are inversely proportional. True / False **(K2-U, CO-1)**
2. The abbreviation for MIDI is _____**(K2-U, CO-2)**
3. Drums is an example of percussion instruments. Say True / False. **(K2-U, CO-3)**
4. Which one of the following instrument is a wind instrument? **(K2- U, CO-4)**
   a) Whistles b) xylophone c) cymbals d) guitars
5. Which one of the following is an example for digital recording? **(K1-R, CO-5)**
   a) VCD b) CD
   c) Floppy d) film

Part B (4 marks)

1. Write short notes on propagation of sound waves in air **(K2-U, CO-1)**
2. Write the difference between traveling waves and standing waves **(K2-U, CO-2)**
3. Explain the sine and cosine waves? **(K2-U, CO-3)**
4. Explain the mechanism of vocal sound production. **(K2-U, CO-4)**
5. How did Edison phonogram workst? **(K1-R, CO-5)**

Part C (8 marks)

1. Give a detailed account on psychoacoustics. **(K2-U, CO-1)**
2. Discuss the concept of simple harmonic motion. **(K2-U, CO-2)**
3. Describe the superposition of simple tones in detail. **(K2-U, CO-3)**
4. Discuss the types of stringed instruments with example. **(K2-U, CO-4)**
5. Give a detailed account on digital signal processing. **(K1-R, CO-5)**

Dr. V. Shally
Head of the Department

Dr. S. Virgin Jeba
Course Instructor

Teaching Plan

Department : Physics
Title of the Course : Skill Enhancement Course – Digital Photography
Semester : II
Course Code : PU232SE1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU232SE1	2		-	-	2	2	30	25	75	100

Prerequisites:

Basic Knowledge in optics and imaging.

Learning Objectives:

1. To understand the principles of photography and image formation and the science and arts behind it.
2. To understand the essential components of conventional and digital cameras and also the different image processing techniques.

Course Outcome

On the successful completion of the course, student will be able to**:**		
1	describe the principle of image formation in Photography	**K2**
2	apply the parameters for controlling the images	**K3**
3	identify different types of camera	**K4**
4	explain the image formation in Digital Photography	**K2**
5	illustrate the digital image – postproduction procedures	**K3**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Teaching plan

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

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	Reference Books	E-resources	Assessment/ Evaluation
I	1.	Principle – chemical route and digital route	1	1	K2(U)	Lecture using Chalk and talk ,Introductory session,	Brainstroming, Discussion of experiences	Michael J. Langford, Anna Fox & Richard Sawdon Smith, 2010, Basic Photography, 9th edition, Focal press, London	Video Lectures, Interactive notes	Conceptual Quiz, Formative worksheet, CIA-I
	2.	light, wavelengths, colours – shadows	1		K2 (U)	Peer tutoring, Lecture using videos, PPT	Formulating questions		Desmos, Interactive PPT, Youtube videos	Open Book Exam, short oral test, CIA-I
	3.	light intensity and distance – making light form images	1		K2(U)	Lecture using Chalk and talk , Mind mapping	Think-pair-share, group activities		Physics libre texts, youtube visual models	Matching exercises, diagram based MCQs, CIA-I
	4.	pin-hole images – practical limitations to pin-hole images – lens instead of pin-hole	1		K2(U)	Peer tutoring, Lecture using videos,	Think-pair-share, group activities		Physics libre texts, youtube visual models	Matching exercises, diagram based MCQs, CIA-I
	5.	focal length and image size – imaging of closer subjects.	1		K2(U)	Reflective pedagogical approach, peer teaching	Group discussion and activities, debates		Lab Videos, Libre texts, Interactive PPT	Oral quiz, activity worksheet, CIA-I

II	1.	Photographic lens – focal length and angle of view (problems)	1	1	K3(Ap)	Concept Mapping, experiential learning, reflective approach	Think-Pair-Share, working through problems	Michael J. Langford, Anna Fox & Richard Sawdon Smith, 2010, Basic Photography, 9th edition, Focal press, London	YouTube lecture videos, physics galaxy channel, libre text	conceptual MCQs, table analysis task, CIA-I
	2.	focusing movement – aperture and f-numbers (problems)	1		K3(Ap)	Inquiry based learning, peer teaching	Lab Analysis		Video Lecture	Formative Quiz using Nearpod / Kahoot / Google Forms, CIA I
	3.	depth of field– depth of focus – image stabilization	1		K2 (U)	Active learning, Flipped classroom	Brainstorming, Group discussions		*Video Lectures,* Simulations, web tools	Formative Quiz using Google Forms, CIA I
	4.	lenses for digital cameras	1		K2(U)	Lecture using Chalk and talk , Group Discussion, Mind mapping	Think-Pair-Share, Concept Mapping		Youtube lecture videos, Interactive PPT	Assignment, conceptual MCQs, short test, CIA-I
	5.	lens and camera care	1		K2(U)	Peer tutoring, Lecture using videos, Derivation , PPT, Review	Peer teaching , Quiz, Explaining concepts and derivations		Interactive Notes, Online Tutorials and Notes: HyperPhysics	Open Book Exam Questions, CIA I
III	1.	Camera and its essential components	1	1	K2(U)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping,	Animation-based learning, Think-pair-share	Michael J. Langford, Anna Fox & Richard Sawdon Smith, 2010, Basic Photography, 9th edition, Focal press, London	HyperPhysics, NPTEL lectures	Peer-assessed derivation, conceptual quiz, CIA-I Problem-

	2.	shutter – aperture – light measurement – film housing	1		K2(U)	Diagram-Based, reflective pedagogical approac	Group Presentation, peer feedback on reflective practices		Thermo Simulators, Youtube video lectures	Solving Assignments, Open Book Exam Questions, CIA I Peer-assessed derivation, conceptual quiz, CIA-I Formative Quiz using Google Forms, CIA II
	3.	camera types: view camera– view finder camera	1		K4(An)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT	Animation-based learning, Think-pair-share		HyperPhysics, NPTEL lectures	
	4.	Reflex camera	1		K4 (An)	Conceptual Demonstration, Flipped Classroom	Peer Teaching, Gamified Quiz, Concept Mapping.		NPTEL Lectures, Khan Academy Physics – Conceptual videos	
										Conceptual MCQ, Peer discussions and concept maps, CIA-II

	5.	single lens reflex (SLR) camera	1		K4(An)	Lecture using Chalk and talk , Group Discussio n, Mind mapping	Animation-based learning, Think-pair-share		HyperPhysics, NPTEL lectures	
IV	1.	Principle of digital image capturing – comparison of digital and analog picture information	1	1	K2(U)	Lecture using Chalk and talk , Group Discussion , Mind mapping	Assign pre-class video viewing and	Michael J. Langford, Anna Fox & Richard Sawdon Smith, 2010, Basic Photography, 9th edition, Focal press, London	Youtube lecture videos, Interactive PPT	Evaluation through: short Class Test, Oral quiz, CIA II
	2.	megapixel – grain, noise and pixel density	1		K2 (U))	Concept Mapping, experiential learning, reflective approach	Think-Pair-Share, working through problems		physics galaxy channel, libre text	Assignment, conceptual MCQs, table analysis task, CIA-II
	3.	optical and digital zooming – image stabilizer – bit depth – white balance	1		K2 (U)	Peer tutoring, Lecture using videos,	Brainstorming , Group discussions		*Video Lectures,* Simulations, web tools	Formative Quiz using Google Forms, CIA II
	4.	colour modes – file formats (TIFF, RAW & JPEG) – storage cards and types	1		K2(U)	Lecture using Chalk and talk Mind mapping	Think-Pair-Share, Concept Mapping		Youtube lecture videos, Interactive PPT	Assignment, conceptual MCQs, short test, CIA-II
	5.	digital cameras: camera phones – compact camera – hybrid camera – digital SLR	1		K2(U)	Peer tutoring, Lecture using videos, PPT, Review	Peer Teaching, Gamified Quiz, Concept Mapping.		Academy Physics – Conceptual videos	Poster/chart Presentation, Short-answer conceptual questions, CIA II

V	1.	Hardware: computer and its peripherals – software: saving digital file – basic editing: navigating the image – undo/redo/history – crop – rotate – brightness &amp	1	1	K2(U)	Lecture using Chalk and talk , Group Discussion, Derivation	Debate, answering questions from peers	Michael J. Langford, Anna Fox & Richard Sawdon Smith, 2010, Basic Photography, 9th edition, Focal press, London	HyperPhysics, Visual and animated tutorials	Quick quizzes - Concept check MCQs, CIA-II
	2.	colour balance – hue/saturation – dodge/burn-cloning & amp	1		K2 (U)	Inquiry-Based Learning, Visual/Graphical Pedagogy	Animation-based learning, Think-pair-share		HyperPhysics, NPTEL lectures	Peer-assessed conceptual quiz, CIA-II
	3.	retouching – removing an element in an image	1		K2(U)	Peer tutoring, Lecture using videos,	Peer Teaching, Gamified Quiz, Concept Mapping.		Physics – Conceptual videos	Short-answer conceptual questions, CIA II
	4.	advanced editing: histogram/levels – curves	1		K2(U)	Lecture using Chalk and talk ,Derivation	Think-pair-share, group activities		Physics libre texts, youtube visual models	Matching exercises, diagram based MCQs, CIA-II
	5.	selection tools: magic wand – printing digital images: inkjet printer – laser printer – dye sub printer – lambda/ light jet printers.	1		K2(U)	Peer tutoring, Lecture using videos,	Group discussion and activities,		Interactive PPT	Oral quiz, activity, CIA-II

Course Focussing on Employability/ Entrepreneurship / Skill Development:

Skill Development

Activities (Em/ En/SD): **Group Discussion**

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment

Sustainability/ Gender Equity): **Professional Ethics**

Activities related to Cross Cutting Issues: **Album making- Camera and is essential components**

Assignment: (Mention Topic and Type): **Digital Cameras - descriptions through Google Classroom**

Seminar Topic: (if applicable): -

Sample questions (minimum one question from each unit)

Sample Questions

Part A (1 mark)

1. The abbreviation for SLR is _____ **(K2-U, CO-2)**
2. View finder camera is one of the types of camera. Say True / False. **(K2-U, CO-3)**
3. Frequency and wavelength are inversely proportional. True / False **(K2-U, CO-1)**
4. Which one of the following is used to save the file as image document? **(K2- U, CO-4)**
   a) Adobe reader b) Notepad c) JPEG d) BIT
5. Which one of the following is an example for digital recording? **(K1-R, CO-5)**
   a) VCD b) CD
   c) Floppy d) film

Part B (4 marks)

1. Write short notes on pin hole images. **(K2-U, CO-1)**
2. Write short note on lens and camera care **(K2-U, CO-2)**
3. Explain the essential components of camera. **(K2-U, CO-3)**
4. Explain the mechanism of digital image capturing. **(K2-U, CO-4)**
5. Write short notes on selection tools. **(K1-R, CO-5)**

Part C (8 marks)

1. Give a detailed account on principle of chemical route and digital route. **(K2-U, CO-1)**
2. Discuss the concept of photographic lenses. **(K2-U, CO-2)**
3. Describe the different types of camera. **(K2-U, CO-3)**
4. Discuss the types of digital cameras. **(K4-An, CO-4)**
5. Give a detailed account on lambda / light jet printers. **(K1-R, CO-5)**

Dr. V. Shally

Head of the Department

Dr. S. Virgin Jeba

Course Instructor

Teaching Plan

Department : **Physics**
Class : **II B.Sc. Physics**

Title of the Course : **CORE COURSE IV: OPTICS AND SPECTROSCOPY**

Semester : **IV**

Course Code : **PU234CC1**

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU234CC1	5	–	–	–	5	5	75	25	75	100

Learning Objectives

1. To provide an in-depth understanding of the basics of various phenomena in geometrical and wave optics and explain the behaviour of light in different mediums.
2. To comprehend the variations in the major phenomena interference, diffraction, and polarization and to use the understanding in day-to-day activities.

Course Outcomes

COs	Upon completion of this course, students will be able to:	PSO addressed	CL
CO-1	outline basic knowledge of methods of rectifying different defects in lenses, articulate technological applications of eyepieces.	PSO - 1	K1(R)
CO-2	understand the wave nature of light through working of interferometer.	PSO - 1	K2(U)

CO-3	apply the knowledge of nature of light through diffraction techniques and apply mathematical principles to analyse the optical instruments.	**PSO - 3**	**K3(Ap)**
CO-4	categorise basic formulation of polarization and appraise its usage in industries.	**PSO - 3**	**K4(An)**
CO-5	evaluate the principles of optics to various fields of IR, Raman and UV spectroscopy and understand their instrumentation and application in industries	**PSO - 2**	**K5(E)**

Teaching plan

Total Contact hours: 75 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation
I		**LENS AND PRISMS**							
	Module	Topic	Teaching Hours	Assessment Hours	Cognitive Level	Pedagogy	Student Centric Method	E-Resources / Assessment	Module / Topic
	1.	Lens Maker's Formula – Derivation, assumptions, applications	4 hrs	1 hr	K2(U), K3(Ap)	Lecture, derivation, demo	Think-pair-share, problem solving	NPTEL, HyperPhysics / Quiz, Problems	Short questions, Quiz
	2.	Combination of Lenses – Equivalent focal length	3 hrs		K3(Ap)	Worked examples	Peer instruction	PhET, Textbooks / Numerical test	Viva, Numerical problems

	3.	Aberrations – Spherical & Chromatic	5 hrs	1 hr	K4(An), K3(Ap)	Ray diagrams, explanation	Group discussion	PhET, Animations / Short answers	Worksheet, Derivation test
	4.	Prisms – Dispersion & Deviation	4 hrs		K1(R) K2(U)	Derivations, demo	Lab activity	Virtual labs / Viva, Problems	Diagram test, Quiz
2		**INTERFERENCE**							
	1.	Fundamentals of Interference – Definition, conditions, division of wavefront & amplitude	4 hrs	1 hr	K1(R) K2(U)	Lecture, Ray diagrams	Think–Pair–Share, Concept maps	NPTEL, HyperPhysics, PPTs	Short questions, Quiz
	2.	Fresnel's Biprism & White-Light Fringes – Theory, fringe width, white-light effects	5 hrs	1 hr	K1(R) K3(Ap)	Demonstration, Derivations	Group activity, Lab observation	Virtual labs, YouTube animations	Viva, Numerical problems
	3.	Thin Film Interference – Reflected & transmitted light, Air wedge, Newton's rings	5 hrs	1 hr	K4(An), K3(Ap)	Derivations, Thin-film demos	Group problem solving	PhET simulations	Worksheet, Derivation test
	4.	Michelson Interferometer – Theory, construction, path	4 hrs	1 hr	K2(U), K3(Ap)	Device working diagrams	Hands-on model demonstration	MIT/YouTube animations	Diagram test, Quiz

		difference, fringe formation							
	5.	Applications of Michelson Interferometer – λ determination, D1–D2 separation of sodium lines	5 hrs	2 hrs	K3(Ap)	Application-based teaching	Mini project, Data analysis	Spectroscopy videos	Viva, Assignment, Mini-project
3		**INTERFERENCE**							
	1.	Fundamentals of Interference – Definition, conditions, division of wavefront & amplitude	4 hrs	1 hr	K1(R) K2(U)	Lecture, Ray diagrams	Think–Pair–Share, Concept maps	NPTEL, Hyper Physics, PPTs	Short questions, Quiz
	2.	Fresnel's Biprism & White-Light Fringes – Theory, fringe width, white-light effects	5 hrs	1 hr	K1(R) K3(Ap)	Demonstration, Derivations	Group activity, Lab observation	Virtual labs, YouTube animations	Viva, Numerical problems
	3.	Thin Film Interference – Reflected & transmitted light, Air wedge, Newton's rings	5 hrs	1 hr	K3(Ap)	Derivations, Thin-film demos	Group problem solving	PhET simulations	Worksheet, Derivation test
	4.	Michelson Interferometer –	4 hrs	1 hr	K2(U)	Device working diagrams	Hands-on model demonstration	MIT/YouTube animations	Diagram test, Quiz

		Theory, construction, path difference, fringe formation							
	5.	Applications of Michelson Interferometer – λ determination, D1–D2 separation of sodium lines	5 hrs	2 hrs	K3(Ap)	Application-based teaching	Mini project, Data analysis	Spectroscopy videos	Viva, Assignment, Mini-project
IV		**POLARIZATION**							
	1.	Polarizer and analyser	3	1 1	K2(U) , K3(Ap)	Lecture, PPT	Think–Pair–Share	NPTEL videos, YouTube	Short test, oral questioning
	2.	Double refraction – optic axis – principal plane	3		K2(U)	Board work, Demonstration	Group discussion	HyperPhysics, e-texts	Worksheet, diagram explanation
	3.	Huygens's explanation of double refraction in uniaxial crystals	4	1 1 1	K2(U)	ICT-enabled teaching, PPT	Collaborative learning	MIT OCW, NPTEL	Short answers, conceptual questions
	4.	Polaroids and applications	3		K2(U), K3(Ap)	Demonstration, examples	Case-based learning	Optical instrument sites	Test, application-based questions
	5.	Circularly and elliptically polarized light	3		K2(U) , K3(Ap)	Lecture, diagrams	Peer learning	NPTEL polarization videos	MCQs, diagram evaluation
V		**SPECTROSCOPY**							

	1	Topic	Teaching Hours	Assessment Hours	Cognitive Level	Pedagogy	Student Centric Method	E-Resources	Assessment/Evaluation
	2	Infrared Spectroscopy – Near & Far IR, Properties	6	1 1	K2(U) , K3(Ap)	Lecture with PPT	Think–Pair–Share	NPTEL videos	Short quiz
	3	IR Sources, IR Detectors & IR Spectrophotometer	6		K2(U) , K4(An)	Demonstration	Model making	Virtual lab simulations	Diagram label test
	4	Applications of IR Spectroscopy	4	1 1	K3(Ap) K4(An)	Case examples	Assignment	Research articles	Viva
	5	Raman Effect – Scattering of Light & Experimental Study	6		K3(Ap) K4(An)	Activity-based learning	Group discussion	NPTEL Raman	Quiz

Course Focussing on Employability/ Entrepreneurship/ Skill Development: **Skill Development**

Activities (Em / En /SD): Create simple models to demonstrate energy principles.

Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): - Environment Sustainability activities related to Cross Cutting Issues:-

Assignment: Compute the work done=1/2 kx^2 and cross check with work done in stretching. (Last date to submit20-1.2025)

Seminar Topic: (if applicable):-

Sample questions (minimum one question from each unit)

Part A

1. **Spherical aberration in a lens occurs because: (K1 - R, CO - 1)**

   A) Light rays passing through different parts of the lens focus at different points.

   B) Different wavelengths focus at different points.

   C) Light rays bend away from the principal axis.

   D) Light rays passing through the center of the lens focus closer than those at the edges.

2. **The central fringe in Newton's rings appears dark because: (K1 - R, CO - 2)**

   A) All light is reflected at the glass-air interface.

   B) The thickness of the air film is zero at the center.

   C) There is maximum light interference at the center.

   D) The wavelength of light is halved at the center

3. State True / False. A zone plate acts like a concave lens. **(K3 - Ap, CO - 3)**

4. If an analyzer is rotated by 45° from the direction of polarization, by what factor does the transmitted light intensity change? **(K2 - U, CO - 2)**

   (A) It doubles
   (B) It becomes zero
   (C) It reduces by half
   (D) It remains the same

5. What is the main reason IR spectroscopy is particularly effective in identifying functional groups in organic compounds? **(K2- U, CO -2)**

   (A) Functional groups have unique bond lengths.

(B) Functional groups absorb IR light at specific frequencies.
(C) IR spectroscopy can identify isotopes.
(D) Functional groups fluoresce under IR light.

Part B

1. Derive the Lens Maker's Formula for a thin lens. **(K1 - R, CO - 1)**
2. Explain the principle of Fresnel's biprism and derive the formula for the fringe width in the interference pattern formed by a biprism. **(K2- U, CO -2)**
3. Explain Fresnel diffraction and discuss how it differs from Fraunhofer diffraction.**K3- Ap, CO-3)**
4. **Compare and contrast** the roles of a polarizer and an analyzer in a setup to observe polarized light. How does each component affect the intensity and orientation of the transmitted light? **(K4- An, CO -4)**
5. **Assess the impact** of IR spectroscopy in the structural analysis of organic compounds. How effective is IR spectroscopy for determining functional groups compared to other spectroscopic methods? **(K5- E, CO -5)**

Part C

1. Discuss chromatic aberration in detail, including its causes, effects on image quality, and methods for correction. **(K1 - R, CO - 1)**
2. Derive the expression for the radius of the nth dark ring in Newton's rings experiment. How the experiment can be used to determine the wavelength of light. **(K2- U, CO -2)**
3. Describe the Fraunhofer diffraction pattern observed from a single slit. Derive the condition for the angular position of minima. **(K3- Ap, CO -3)**
4. **Examine the reasons** why certain materials are better suited to function as polarizers or analyzers. What characteristics of these materials contribute to their effectiveness in polarizing light? **(K4- An, CO -4)**
5. **Justify the use of** Raman spectroscopy over other spectroscopic methods in fields such as medical diagnostics and chemical analysis. What unique advantages does it offer for molecular identification? **(K5- E, CO -5)**

Head of the department

Dr.S.J.Jenepha Mary –Course Instructor

Teaching Plan

Department : Physics
Class : II B.Sc. Physics
Title of the Course : Core Lab Course III: General Physics Lab III
Semester : IV
Course Code : PU234CP1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU234CP1			3		3	3	45	25	75	100

Pre-requisite:
Knowledge on basic Physics, Optics and Mathematics.

Learning Objectives:

1. To understand the basic concepts of electromagnetic radiation and their behavior in encounters different mediums, including the principles behind mirrors and lenses
2. To comprehend the principles of interference, diffraction, and polarization.

Course Outcomes

On the successful completion of the course, student will be able to**:**		
1	identify the dual nature of light, understanding it as both a wave and a particle.	**K1 & K2**
2	understand and explore nonlinear optics, laser spectroscopy, interferometry, and laser-based measurements.	**K3**
3	use the optical principles involved in the different medium including the principles behind mirrors and lenses.	**K4**
4	devise light paths through lenses, grating and mirrors.	**K5**
5	prioritize the applications problems related to laser physics and develop a prototype.	**K6**

K1 - Remember; **K2** - Understand; **K3** - Apply; **K4** - Analyze; **K5** - Evaluate; **K6**– Create

Total Contact hours: 30 (Including Practical Classes and Assessments)

Unit	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods

1	Determination of refractive index of prism using spectrometer.	6	1	K2	Demonstration and guided inquiry-based lab	Hands-on experimentation, collaborative learning, reflective journaling	Virtual spectrometer labs, NPTEL Optics videos	Practical performance, observation record
2	Determination of radius of curvature of lens by forming Newton's rings.	6	1	K3	Problem-solving approach with schematic analysis	Peer discussion, group analysis of bridge circuits, drawing circuit diagrams	Newton's rings simulations, animated videos	Numerical calculation, viva-voce
3	Determination of thickness of a wire using air wedge.	7	1	K2	Experimental approach with theoretical correlation	Predict-Observe-Explain, Group presentations, Graphical analysis using real-time data	Virtual interference experiments, NPTEL videos	Record evaluation, error analysis
4	Determination of thickness of wire using Laser.	7	1	K3	Constructivist approach with analog circuit modeling	troubleshooting circuits, Hands-on wiring, Pair programming for simulations	Virtual diffraction simulations	Practical test, numerical problems
5	Determination of wavelengths, particle size using Laser/Monochromatic source.	6	1	K4	Constructivist approach with analog circuit modeling	troubleshooting circuits, Hands-on wiring, Pair programming for simulations	Laser optics simulations, educational videos	Skill assessment, viva-voce

6	Determination of resolving power of grating	7	1	K3	Inquiry-based pedagogy with integrated field concepts	Case study on Earth's magnetism, Experimental journaling, Peer instruction	Virtual spectrometer labs, NPTEL Optics videos	Practical performance, observation record

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Employability, Skill Development

Activities (Em / En /SD): Hands on Training , Project

Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): NIL

Environment Sustainability activities related to Cross Cutting Issues: NIL

Sample Questions

1. Determination of refractive index of prism using spectrometer.
2. Determination of radius of curvature of lens by forming Newton's rings.
3. Determination of thickness of a wire using air wedge.
4. Determination of refractive index using Laser.
5. Determination of wavelengths, particle size using Laser/Monochromatic source.
6. Determination of thickness of wire using Laser.

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Head of the department **Course Instructor**

Teaching Plan

Department : Physics

Class : II B.Sc Chemistry

Title of the Course: Elective Course IV: Allied Physics for Chemistry - II

Semester : IV

Course Code : PU234EC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU234EC1	4	-	-	-	3	4	60	25	75	100

Learning Objectives:

1. To obtain an all-encompassing comprehension of the basic ideas of physics.
2. To analyse the fundamental ideas behind optic, electronics, relativity and quantum physics.

Course Outcomes

On the successful completion of the course, student will be able to**:**		
1.	explain the notions of interference, diffraction and polarization using principles of superposition of waves.	**K1**
2.	understand the basic foundation of different atom models and periodic classification of elements.	**K2**
3.	apply the basic concepts of relativity like inertial frames and get an overview of research projects of National and International importance.	**K3**
4.	relate the properties of nuclei, nuclear forces, structure of atomic nucleus and nuclear models.	**K4**
5.	Defend the working of semiconductor devices like junction diode, Zener diode and practical devices.	**K5**

Teaching Plan

Total Contact hours: 60 (Including lectures, assignments, and tests)

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation
I	**OPTICS:**								
	1	Interference – interference in thin films – colours of thin films – air wedge	2	1	K1(R)	Lecture using chalk and talk, Introductory session, Group discussion Mind mapping	Think-Pair-Share, working through problems	YouTube lecture videos, physics galaxy channel, libre text	Evaluation through: short test, Class test, Multiple choice Questions, Quiz, CIA II
	2	Determination of diameter of a thing wire by air wedge – diffraction normal incidence	2		K2(U)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	Lab Analysis	Video Lecture	Formative assessment, Shorts Summary or Overview, CIA II
	3	Experimental determination of wavelength using diffraction grating (no theory) - polarization	2	1	K3(Ap)	Lecture using chalk and talk, Introductory session, Group discussion Mind mapping	Brainstorming, Group discussions	Video Lectures, Simulations, web tools	Assignment, Conceptual MCQs, Table analysis task, CIA II

	4	Polarization by double refraction – Brewster's law – optical activity – Applictio n in sugar industry	3	1	K1(R)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	Group reasoning, diagram analysis	YouTube experiments, virtual refraction mechanisms	Problem-solving assignments, Open book exam questions, CIA II
II	**ATOMIC PHYSICS:**								
	1	Atom models – Bohr atom model – mass number – atomic number – nucleons – vector atom model – various quantum numbers	3	1	K1(R)	Lecture using chalk and talk, Introductory session, Group discussion Mind mapping	Experimental analogies, Derivation-based activity	Interactive PPT	Evaluation through: short test, Class test, Multiple choice Questions, CIA II
	2	Pauli's exclusion principle – electronic configuration – periodic classification of elements.	3	1	K2(U)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	Derivation with graphs, Interactive Board Activity	Lecture Slides	Poster/chart Presentation, Short-answer conceptual questions, Quiz, CIA II
	3	Stark effect – Zeeman effect	3	1	K3(Ap)	Lecture using chalk and talk,	Graph plotting, Worksheet-based	You Tube Videos, Animation	Formative Quiz using Google

		(elementary ideas only) – photo electric effect – Einstein's photoelectric equation.				Introductory session, Group discussion Mind mapping	practice	s	Forms, Written Assignment- Problem-based worksheet, True/False, CIA II
III	**NUCLEAR PHYSICS:**								
	1	Nuclear models – liquid drop model – shell model – magic numbers	3	1	K1(R)	Lecture using chalk and talk, Introductory session, Group discussion Mind mapping	Group project on nuclear models	NASA, ESA space science videos	Evaluation through: short test, Class test, Multiple choice Questions, Quiz, Shorts Summary or Overview, CIA I
	2	Nuclear energy – mass defect – binding energy curve – Natural radioactivity – half-life – mean life	3	1	K1(R)	Peer tutoring, Lecture using videos, Problem solving, Demonstration PPT, Review	Collaborative analysis	Nuclear instrumentation videos, Animated working principle videos	Descriptive test, Numerical evaluation, CIA I
	3	Nuclear fission and fusion – comparison – energy released	3	1	K2(U)	Lecture using chalk and talk, Introductory session, Group	Debate: "Future India – Energy Production"	Nuclear Physics, Khan Academy	Debate rubric, conceptual MCQ, Short-answer

		in fission – thermonuclear reactions				discussion Mind mapping			test, CIA I
IV	**NUCLEAR REACTORS:**								
	1	Chain reaction – Controlled chain reaction – uncontrolled chain reaction – Atom bomb	3	1	K1(R)	Lecture using chalk and talk, Introductory session, Group discussion Mind mapping	Student poster creation on chain reactions	IAEA e-learning modules, YouTube animations	Evaluation through: Multiple choice Questions, Quiz, Formative assessment, Shorts Summary or Overview, CIA I
	2	Nuclear reactor – Construction and Working – breeder reactor - types	3	1	K1(R)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	Group project on nuclear reactor models	IOP animations	Presentation assessment, Seminar assessment, cycle-based numerical test, CIA II
	3	Introduction to Department of atomic energy (DAE) – International atomic energy agency	3	1	K2(U)	Lecture using chalk and talk, Introductory session, Group discussion Mind mapping	Group discussion analysing atom models	NPTEL lectures on nuclear energy, IAEA resources	Case analysis, short assignment, Project submission, CIA II

		(IAEA)							
V	**NANOMATERIALS IN FUEL CELL APPLICATIONS:**								
	1	P-N junction diode – forward and reverse biasing – characteristic of diode	3	1	K1(R)	Lecture using chalk and talk, Introductory session, Group discussion Mind mapping	Circuit analysis, Real-time simulation	YouTube Videos, Lab Demos	Evaluation through: short test, Class test, Formative assessment, Shorts Summary or Overview, CIA I
	2	Zener diode – Characteristic of Zener diode – voltage regulator	3	1	K3(Ap)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	Board Work + Interactive Quiz	Circuit Diagrams, All About Electronics	Concept map evaluation, reflective writing, Oral Questions CIA I
	3	USB cell phone charger – Introduction to e-vechicles and EV charging stations	3	1	K2(U)	Lecture using chalk and talk, Introductory session, Group discussion, Mind mapping	Real-world Applications Discussion	PPT, Journal Articles	Worksheet interpretation, group presentation, application-based questions evaluating understanding, CIA I

Course Focussing on Employability/ Entrepreneurship/ Skill Development: **Skill Development**

Activities (Em/ En/SD): **Model making**

Course Focussing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): **Nil**

Activities related to Cross Cutting Issues: **Nil**

Assignment: (Mention Topic and Type): **Nuclear fission and fusion – Model making**

Seminar Topic: (if applicable):

Sample questions (minimum one question from each unit)

Part A (1 mark)

1. The phenomenon of superposition of two coherent waves in the region of superposition is **(K1-R, CO-1)**
   (a)Reflection (b) refraction (c) polarization (d) interference
2. No two electrons in an atom exist in the same quantum state. State True / False **(K3-Ap, CO-2)**
3. _____ is the difference between the experimentally measured mass of the isotope and its mass number. **(K2-U, CO-3)**
4. In nuclear fusion process, two or more light nuclei combine to form a single heavy nucleus. State True /False. **(K3-Ap, CO-4)**
5. The Zener diode operates in the _____ breakdown region. **(K3-Ap, CO-5)**

Part B (3 marks)

6. State and prove Brewster's law. **(K2- U, CO-1)**
7. What is the principle of Zeeman effect? **(K3-Ap, CO-2)**
8. Compare nuclear nuclear fission and fusion. **(K2-U, CO-3)**
9. Give the difference between controlled and uncontrolled chain reaction. **(K3-Ap, CO-4)**
10. Write short note on Zener diode. **(K3-Ap, CO-5)**

Part C (7 marks)

11. Determine the diameter of a thin wire by air wedge. **(K2-U, CO-1)**
12. With neat sketch explain Bohr atom model. **(K3-Ap, CO-2)**
13. Give a detailed account on binding energy and binding energy curve. **(K2-U, CO-3)**
14. Explain the different parts of nuclear reactor using neat diagram. **(K3-Ap, CO-4)**
15. Elucidate the characteristics of Zener diode. **(K3-Ap, CO-5)**

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S. Sebastiammal

Dr. Sr. S. Sebastiammal
Course Instructor

Teaching Plan

Department : Physics

Class : II B.Sc. Chemistry

Title of the Course : Elective Lab Course IV: Allied Physics Practical for Chemistry – II

Semester : IV

Course Code : PU234EP1

CourseCode	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU234EP1	-	-	2	-	2	2	30	25	75	100

Pre-requisite:

Basic Knowledge in physics experiments.

Learning Objectives:

1. To apply various Physics concepts to understand concepts of Light, electricity and magnetism and waves.
2. To set up experimentation for verifying theories, to do error analysis and correlate results.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	identify the nature of monochromatic light and its diffraction and interference phenomenon.	**K1**
2.	understand the concept of frequency measurements.	**K2**
3.	use the physical principle involved in the various instruments to perform experiments.	**K3**
4.	devise scientific method and examine it in practice.	**K4**
5.	defend logic theorems and design simple logic circuits.	**K5 & K6**

K1-Remember; **K2** -Understand; **K3** -Apply; **K4** -Analyse; **K5**-Evaluate; **K6**-Create

Total Contact hours: 30 (Including Practical Classes and Assessments)

Unit	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
1	Thickness of a wire using air wedge	4	1	K2	Inquiry-Based Learning, Project-Based Learning	Real world application of skills, Peer Learning through group tasks	Virtual labs by MHRD vlab.co.in	concept explanation, teamwork, result accuracy, Model Exam
2	Verification of Newton's law of cooling	4	1	K3	Constructivist Pedagogy, Activity-Based Learning	Peer Teaching, Think-Pair-Share	Physics galaxy YouTube channel, Lab manuals	Result accuracy, Lab report with calculation, team work
3	Specific heat capacity of liquid by cooling method	4		K4	Experiential Learning, Inquiry-Based Pedagogy	Lab work, Peer Learning through group tasks	NPTEL nptel.ac.in, Amrita virtual labs amritavlab.amrita.edu	Concept-based oral questions, Lab report with calculated vs observed values, Peer evaluation on troubleshooting skills, Model Exam
4	Determination of AC frequency using sonometer	4	1	K2	Blended Learning, Demonstration method	Hands-on circuit construction and real-time experimentation	Amrita virtual labs amritavlab.amrita.edu	Oral Q&A, Trouble shooting questions, circuit construction, Model Exam
5	Characteristics of Zener diode	5	1	K6	Constructivist approach with analog circuit modeling	Troubleshooting circuits, Hands-on wiring, Pair programming for simulations	YouTube Videos VMR Academy	Analysis of V-I graph, Lab file review, Oral Q&A
6	Radius of curvature of lens by forming Newton's rings	4	1	K4	Reciprocal Learning	Real-time experimentation	Amrita virtual Labs, All Lab Experiments (YouTube)	Oral Q&A, Concept explanation, Model Exam

Course Focussing on Employability/ Entrepreneurship/ Skill Development:
Employability, Skill Development

Activities (Em / En /SD): Hands on Training, Project

Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity):NIL

Environment Sustainability activities related to Cross Cutting Issues: NIL

Sample Questions

1. Form an air wedge with sodium lamp (λ=5893A^0) and a thin wire. Find the thickness of the wire.
2. Verify Newton's law of cooling using spherical calorimeter.
3. Determine the specific heat capacity of the given liquid by cooling method.
4. Determine the frequency of A.C mains using sonometer.
5. Construct Zener Diode in Forward and Reverse bias. Draw Voltage-Ampere characteristics of Zener diode.
6. Find the radius of curvature of the given lens by forming Newton's ring. Determine the refractive index of the material of the lens, assuming the other side also has the same radius of curvature. Find the focal length of the lens by distant object method.

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Teaching Plan

Department : Physics
Class : III B.Sc. Physics
Title of the Course : Core Course –VII: Nuclear and Particle Physics
Semester VI
Course Code : PU236CC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU236CC1	6	-	-	-	5	6	90	25	75	100

Learning Objectives:

1. To acquire knowledge on static properties of nuclei and its stability.
2. To understand the background of various nuclear models.

Course Outcomes

On the successful completion of the course, students will be able to**:**		
1.	understand constituents, properties and models of nucleus.	**K1 & K2**
2.	give reason for radioactivity and study their properties	**K1 & K2**
3.	learn about the principles of various particle detectors and accelerators	**K2 & K3**
4.	acquire knowledge on different types of nuclear reactions and their applications.	**K3 & K4**
5.	Know the reason for cosmic rays and their effect on the surface of earth and also understand the classification of elementary particles.	**K4&K5**

Teaching Plan

Total Contact Hours: 75 (Including Lectures, Assignments and Tests)

Unit	Module	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation
I	**Properties of Nucleus**								
	1.	Constituents of nucleus – isotopes, isobars, isotones – nuclear size, mass, density, charge, spin, angular momentum, magnetic dipole moment, electric quadrupole moment (qualitative)	5	2	K1 (R)	Concept-based teaching, diagrams, model explanation, real-world applications	Think–Pair–Share, collaborative learning, problem-solving groups, inquiry-based tasks	NPTEL videos, YouTube animations, open-source e-notes	MCQs, short notes, numerical problems, presentations, assignments, CIA I
	2.	binding energy – mass defect – packing fraction – nuclear	3		K2 (U)	Interactive lecture focusing on binding energy and guided	Student-led discussion, group activity,	NPTEL videos, simulations, research articles, and	MCQs, short answers, and application-

		stability – binding energy per nucleon graph				reasoning.	and problem-solving	animations	based questions evaluating understanding of binding energy, CIA I
	3.	properties of nuclear force – meson theory of nuclear forces – Yukawa potential.	3		K2 (U)	Demonstration of nuclear force	Virtual lab, peer discussion	YouTube videos	Oral Questions on Yukava potential, CIA 1
	4.	Liquid drop model– Weizacker's semi-empirical mass formula –shell model– magic numbers.	4	1	K2 (U)	Concept-based teaching, diagrams, model explanation, real-world applications	Think–Pair–Share, collaborative learning, problem-solving groups, inquiry-based tasks	NPTEL videos, YouTube animations, simulation tools, open-source e-notes	MCQs, short notes, numerical problems, presentations, assignments, CIA I
II	**Radioactivity**								
	1.	Radio activity – laws of radioactivity – radioactive disintegration, decay constant, half-life, mean-life– units of radioactivity– successive disintegration	4	2	K1 (R)	Interactive Lecture with Concept Mapping	Think–Pair–Share for solving decay constant problems	NPTEL Nuclear Physics, Hyper Physics Radioactivity	Short numerical quiz, oral viva, CIA I
	2.	transient and secular equilibrium –properties of alpha, beta and gamma rays	3		K3 (U)	Demonstration-based teaching using visual charts	Group discussion analysing real decay graphs	IAEA e-learning modules, YouTube animations	Worksheet interpretation, group presentation, CIA I
	3.	Geiger-Nuttal law – α ray spectra –Gammow's theory of α decay(qualitative) – β ray spectrum– neutrino theory of β decay	4	1	K3 (U)	Problem-solving session with derivation walkthrough	Case analysis on experimental decay data	Nuclear Physics, Khan Academy	Numerical assignment, conceptual test, CIA I

	4.	nuclear isomerism– K-shell capture– internal conversion – non-conservation of parity in weak interactions	4		K3 (U)	Analogy-based teaching with micro–level models	Jigsaw method (each group explains one concept)	IOP animations	Concept map evaluation, reflective writing, CIA I
III	**Particle Detectors and Accelerators Detectors**								
	1.	Gas detectors –ionization chamber – Geigger-Muller counter – scintillation counter	4	2	K2 (U)	Demonstration with virtual lab simulations	Hands-on virtual experiment (PhET equivalents)	Nuclear instrumentation videos, IAEA lab modules	Lab report, MCQ test, CIA I
	2.	photo multiplier tube (PMT) – semiconductor detectors – neutron detector	3		K3 (Ap)	Diagram-based explanation with device components	Peer teaching – each student explains a detector	Detector manuals, animated working principle videos	Short seminar, spot test, CIA I
	3.	ACCELERATORS Linear accelerators – cyclotron – synchrotron	4		K3 (Ap)	Model-based teaching with working principle sketches	Role-play: students act as particle components in accelerator	CERN education portal, accelerator simulations	Problem set, objective quiz, CIA II
	4.	betatron– electron synchrotron – proton synchrotron.	4	1	K3 (Ap)	Comparative teaching using tabular differentiation	Student poster creation on accelerator types	Documentaries on particle accelerators	Poster evaluation, viva, CIA II
IV	**Nuclear Reactions**								
	1.	Types of nuclear reactions –conservation laws in nuclear reaction – Q-value– threshold energy – nuclear fission – energy released in fission	4	2	K4 (An)	Case-study-based teaching using historical examples	Group project on nuclear reactor models	NPTEL lectures on nuclear energy, IAEA resources	Project submission, written test, CIA II
	2.	chain reaction – critical mass – nuclear reactor – uses – atom bomb – nuclear fusion – sources of stellar energy	4		K4 (An)	Diagram-based teaching with stepwise cycle flow	Student-led seminar on stellar processes	NASA astrophysics resources	Seminar assessment, cycle-based numerical test, CIA II
	3.	proton-proton cycle – Carbon-Nitrogen cycle	3	1	K3 (Ap)	Storytelling pedagogy (discovery perspective)	Problem-based learning on cosmic ray showers	Cosmic ray detector project websites	Case analysis, short assignment, CIA II

	4.	thermonuclear reactions – controlled thermonuclear reactions - hydrogen bomb	4		K3 (Ap)	Multimedia teaching using space simulation videos	Debate: "Future of the Universe"	NASA, ESA space science videos	Debate rubric, conceptual MCQ, CIA II
V	**Cosmic Rays and Elementary Particles**								
	1.	Discovery of cosmic rays –primary and secondary cosmic rays –cascade theory of cosmic ray showers – altitude and latitude effects – discovery of positron – pair production	4	2	K4 (An)	Conceptual discussion	Group examples	Cosmic ray animations	Short-answer test, CIA II
	2.	annihilation of matter – Van-Allen radiation belts – big-bang theory– future of the Universe (elementary ideas only)	4		K4 (An)	Derivation & examples	Problem-solving	Online lectures in Big bang theory	Numerical evaluation, CIA II
	3.	Particles and antiparticles –classification of elementary particles– types of fundamental interactions	3	1	K5 (Ev)	Concept explanation	Collaborative analysis	Classification of elementary particles videos	Descriptive test, CIA II
	4.	quantum numbers of elementary particles – conservation laws and symmetry – quarks and types.	4		K5 (Ev)	Comparative teaching	Student presentation	Online tools to demonstrate conservative laws	Presentation assessment, CIA II

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

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Skill Development

Activities (SD): Hands-on training on the liquid drop model.

Course Focusing on Cross-Cutting Issues(Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): Environment Sustainability

Activities related to Cross-Cutting Issues:-

Assignment: Radioactivity

Sample Questions

Part A

1. Which nuclei has maximum Binding energy per nucleon? **(K1 - R, CO - 1)**
2. The law of radioactive decay states that the rate of disintegration is proportional to the number of _____ present at that instant. **(K1 - R, CO - 2)**
3. A betatron accelerates electrons using a changing _____field. **(K2 - U, CO - 3)**
4. Fusion reaction is difficult at low temperature because: **(K3 - Ap, CO - 4)**
   a) Neutrons are absent
   b) Protons must overcome the Coulomb barrier
   c) Fusion produces too much radiation
   d) Magnetic confinement fails
5. The increase of cosmic ray intensity with altitude is primarily due to the decrease in _____ of the atmosphere. **(K4 - An, CO - 5)**

Part B

1. Derive the relation between mass defect and binding energy. **(K2 - U, CO - 1)**
2. Define decay constant, half-life, and mean-life. Derive the relation among them. **(K2 - U, CO - 2)**
3. Explain how you would identify whether a given parent–daughter system is in transient or secular equilibrium using half-life values. **(K3- Ap, CO -3)**
4. Explain how a nuclear reactor maintains a sustained chain reaction while preventing an explosion. **(K3- Ap, CO -4)**
5. Analyze the differences between primary and secondary cosmic rays in terms of origin, composition, and interaction with the atmosphere. **(K4 - An, CO - 5)**

Part C

1. Describe the shell model of the nucleus and list the magic numbers. **(K2- U, CO -1)**
2. Explain the β-ray spectrum and state the neutrino theory of beta decay. **(K2- U, CO -2)**
3. Calculate the radius of particle motion in a cyclotron given the magnetic field and particle energy. **(K3- Ap, CO -3)**
4. Compare the energy production mechanisms in the proton–proton cycle and C-N cycle. **(K4- An, CO -4)**
5. Evaluate the importance of cosmic-ray studies in the discovery of new particles like the positron, muon, and pion. **(K5- Ev, CO -5)**

Dr. V. Shally

Head of the Department

Dr. P. Aji Udhaya

Course Instructor

Teaching Plan

Department : Physics
Class : III B.Sc. Physics

Title of the Course : Core Course VIII: Solid State Physics

Semester : VI

Course Code : PU236CC2

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU236CC2	6	–	–	–	4	6	90	25	75	100

Learning Objectives

1. To provide an in-depth understanding of the basics of various phenomena in geometrical and wave optics and explain the behaviour of light in different mediums.
2. To comprehend the variations in the major phenomena interference, diffraction, and polarization and to use the understanding in day-to-day activities.

Course Outcomes

COs	Upon completion of this course, students will be able to:	PSO addressed	CL
CO-1	classify bonding types and crystal structures and analyze crystal structures using X-ray diffraction techniques.	PSO - 1	K1(R)
CO-2	understand lattice dynamics and their role in determining the electrical and thermal properties of materials.	PSO - 1	K2(U)

CO-3	explain the classification of magnetic materials based on their behavior and underlying physical principles.	**PSO - 3**	**K3(Ap)**
CO-4	comprehend the dielectric behavior of materials including polarization mechanisms and dielectric breakdown.	**PSO - 3**	**K4(An)**
CO-5	appreciate the properties of ferroelectric and superconducting materials, including their applications in modern technology.	**PSO - 2**	**K5(E)**

Teaching plan

Total Contact hours: 90 (Including lectures, assignments and tests)

Unit	**Module**	**Topic**	**Teaching Hours**	**Assessment Hours**	**Cognitive level**	**Pedagogy**	**Student Centric Method**	**E-Resources**	**Assessment/ Evaluation**
I		**BONDINGIN SOLIDS**							
	Module	Topic	Teaching Hours	Assessment Hours	Cognitive Level	Pedagogy	Student Centric Method	E-Resources / Assessment	Module / Topic
	1.	Types of Bonds in Crystals – Ionic, Covalent, Metallic, Van der Waals, Hydrogen Bonding	6	1	K1(R), K2(U)	Lecture with PPT	Think–Pair–Share	NPTEL Solid State Lectures	Short Quiz
	2.	Bond Energy of Sodium Chloride Molecule	5		K2(U), K3(Ap)	Problem Solving	Assignments	Online derivation notes	Assignment Evaluation
	3.	Variation of Interatomic Force	5	1 1	K4(An)	Graphical Interpretation	Group Problem Solving	Virtual Lab Simulations	Class Test

		with Interatomic Spacing							
	4.	Cohesive Energy & Cohesive Energy of Ionic Solids	6		K3(Ap)	Mathematical Models	Peer Teaching	NPTEL Cohesive Energy Lectures	Written Test
II	**CRYSTAL STRUCTURE**								
	1.	Crystal lattice, lattice translational vectors, lattice with basis, unit cell (primitive & non-primitive)	6	1	Understand (K2), Apply (K3)	Chalk & talk, diagrams, interactive explanation	Think–pair–share, sketching unit cells	NPTEL Solid State Physics videos, MIT OCW simulations	Short tests, diagram-based questions
	2.	Bravais' lattices (3D), Miller indices, procedure for finding Miller indices	6	1	K1(R), K2(U)	Concept explanation with numerical examples	Problem-solving sessions, peer instruction	Crystal lattice visualizers, educational animations	Numerical problems, quizzes, assignments
	3.	Packing in BCC and FCC structures, structures of NaCl and diamond crystals	6	1	K2(U), K3(Ap)	Models, comparative analysis	Model-based learning, group discussions	3D structure apps, NPTEL lectures	Descriptive problems, short-answer tests
	4.	Reciprocal lattice, reciprocal lattice vectors, properties, reciprocal lattices	6	1	K4(An)	Mathematical derivation, guided discussion	Guided derivation, problem-based learning	MIT OCW notes, reciprocal lattice simulations	Derivation-based questions, numerical problems

		of SC, BCC and FCC							
	5.	X-rays, Bragg's law (simple problems), Laue method, powder method, rotating crystal method	6	1	K3(Ap)	Demonstrations using diagrams and flowcharts	Case-study approach, virtual lab exploration	Virtual XRD labs, NPTEL videos	MCQs, numerical problems, viva
III	**MAGNETIC PROPERTIES OF SOLIDS**								
	1.	Magnetic permeability, magnetic susceptibility, relation between permeability and susceptibility	6	1	K1(R), K2(U)	Chalk & talk, mathematical explanation	Problem solving, concept mapping	NPTEL Magnetism lectures, MIT OCW notes	Numerical problems, short tests
	2.	Classification of magnetic materials: diamagnetic, paramagnetic, ferromagnetic, ferrimagnetic and antiferromagnetic materials	6	1	K2(U), K3(Ap)	Comparative explanation with examples	Group discussion, classification charts	Video animations, simulation tools	Descriptive questions, quizzes
	3.	Properties of dia, para, ferro, ferri and antiferromagnetism, Langevin's theory of diamagnetism	6	1	K4(An)	Conceptual teaching with illustrations	Think–pair–share, guided questioning	NPTEL videos, interactive diagrams	Conceptual questions, assignments

	4.	Langevin's theory of paramagnetism, Curie–Weiss law, Weiss theory of ferromagnetism (qualitative)	6	1	K3(Ap)	Derivation outline, qualitative discussion	Peer instruction, problem-based learning	MIT OCW resources, digital notes	Analytical questions, short answers
	5.	Magnetic domains, B–H curve, hysteresis and energy loss, soft and hard magnets	6	1	K3(Ap) K4(An)	Diagram-based teaching, demonstrations	Case studies, real-life applications	Virtual labs, educational videos	Diagram-based questions, viva, MCQs
IV	**DIELECTRIC PROPERTIES OF MATERIALS**								
	1.	Polarization, electric susceptibility, relation between polarization and susceptibility	6	1 1	K1(R), K2(U)	Chalk & talk, conceptual explanation	Concept mapping, guided questioning	NPTEL Dielectrics lectures, MIT OCW notes	Short tests, conceptua questions
	2.	Local electric field of an atom, internal field, dielectric constant, polarizability	6		K2(U), K3(Ap)	Diagram-based teaching, mathematical discussion	Peer discussion, problem solving	Simulation tools, educational animations	Numerical problems, assignments
	3.	Electronic polarization, calculation of electronic polarizability,	6	1 1 1	K4(An)	Step-by-step derivation, illustrations	Think–pair–share, derivation practice	NPTEL videos, interactive simulations	Derivation-based questions, short answers

		ionic and orientational polarization							
	4.	Space charge polarization, Clausius–Mossotti relation, frequency dependence of dielectric constant, dielectric loss	6		K3(Ap)	Analytical explanation, graphical analysis	Case studies, problem-based learning	MIT OCW resources, virtual labs	Numerical problems, analytical questions
	5.	Effect of temperature on dielectric constant, dielectric breakdown and its types	6		K3(Ap) K4(An)	Real-life examples, diagram explanation	Application-based learning, group discussion	Educational videos, digital textbooks	MCQs, short notes, viva
V	**FERROELECTRIC & SUPERCONDUCTING PROPERTIES OF MATERIALS**								
	1	Ferroelectric effect, Curie–Weiss law, ferroelectric domains	6	1 1 1	K1(R), K2(U)	Conceptual teaching with diagrams and examples	Think–pair–share, concept mapping	NPTEL Ferroelectricity lectures, MIT OCW notes	Short tests, conceptua questions
	2	Conductors, semiconductors (P-type & N-type) and insulators – band theory approach	6		K2(U), K3(Ap)	Chalk & talk, energy band diagrams	Interactive discussion, diagram drawing	Simulation videos, band structure animations	Descriptive questions, quizzes

	3	Conductivity of semiconductors, mobility of charge carriers, Hall effect	6		K4(An)	Mathematical explanation with numerical examples	Problem solving, peer learning	NPTEL lectures, virtual semiconductor labs	Numerical problems, assignments
	4	Measurement of conductivity (four probe method), Hall coefficient	6	1 1	K3(Ap)	Experimental method explanation using flowcharts	Virtual lab exploration, case studies	VLAB simulations, demonstration videos	Numerical problems, viva voce
	5	Superconductivity: experimental results, critical temperature, critical magnetic field, Meissner effect, type-I & type-II superconductors, London equations, penetration depth, isotope effect, idea of BCS theory	6		K3(Ap) K4(An)	Concept explanation, qualitative discussion	Seminar presentation, group discussion	NPTEL superconductivity lectures, animations	MCQs, short notes, seminar evaluation

Course Focussing on Employability/ Entrepreneurship/ Skill Development: **Employability and Skill Development**

Activities (Em / En /SD): Create simple models to demonstrate energy principles.

Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): - Environment Sustainability activities related to Cross Cutting Issues:-

Assignment: Compute the work done=1/2 kx^2 and cross check with work done in stretching. (Last date to submit20-1.2025)

Seminar Topic: (if applicable):-

Sample questions (minimum one question from each unit)

Part A

1. Ionic bonding in crystals arises mainly due to: (K1 – R, CO – 1)

A) Sharing of valence electrons
B) Transfer of electrons between atoms
C) Overlapping of atomic orbitals
D) Weak intermolecular forces

2. The Madelung constant in an ionic crystal accounts for **(K1 – R, CO – 1)**

A) Short-range repulsive forces
B) Long-range Coulomb interactions
C) Thermal vibrations
D) Electronic polarization

3. State True / False.

BCC lattice has a packing fraction greater than FCC lattice. **(K2 – U, CO – 2)**

4**. Magnetic susceptibility of a diamagnetic material is: (K2 – U, CO – 3)**

A) Small and positive
B) Large and positive
C) Small and negative
D) Zero

5. **The dielectric loss in a material mainly occurs due to: (K2 – U, CO – 4)**

A) Polarization lag
B) Elastic deformation

C) Lattice expansion
D) Electron emission

Part B

1. Explain different types of bonding in solids. Discuss ionic bonding with reference to sodium chloride crystal. **(K1 – R, CO – 1)**

2. Describe crystal lattice, lattice translational vectors, unit cell and lattice with basis. **(K2 – U, CO – 2)**

3. Explain Langevin's theory of paramagnetism. Bring out its limitations. **(K3 – Ap, CO – 3)**

4. Derive Clausius–Mossotti relation and explain its significance. **(K4 – An, CO – 4)**

5. Explain the principle of four-probe method for measuring electrical conductivity of a semiconductor. **(K5 – E, CO – 5)**

Part C

1. Discuss the variation of interatomic force with interatomic distance and explain the concept of cohesive energy in ionic solids with reference to NaCl crystal. **(K1 – R, CO – 1)**

2. Describe Bravais lattices and explain the procedure for finding Miller indices of a given plane. **(K2 – U, CO – 2)**

3. Discuss the B–H curve for a ferromagnetic material. Explain hysteresis and energy loss. **(K3 – Ap, CO – 3)**

4. Explain various polarization mechanisms in dielectrics and discuss the frequency dependence of dielectric constant. **(K4 – An, CO – 4)**

5. Evaluate the significance of superconductivity in modern technology. Discuss Meissner effect, critical parameters and the basic idea of BCS theory. **(K5 – E, CO – 5)**

Dr. V. Shally
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Head of the department

Course Instructor

SEMESTER VI

CORE LAB COURSE VII: GENERAL PHYSICS LAB VII

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU236CP1	-	-	2	-	**2**	**2**	**30**	**25**	**75**	**100**

Pre-requisite:

Knowledge on Basic principles of diffraction, spectroscopy, fundamentals of electromotive force (EMF), magnetic field and thermoelectric effects.

Learning Objectives:

1. To understand the working principles of optical instruments, potentiometers, and magnetometers for precise experimental measurements in physics.
2. To develop skills in measuring optical constants, resistance, EMF, and magnetic moments using standard laboratory techniques.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	recall and understand fundamental principles of optics, electromagnetism, and thermal physics applied in various experimental setups.	**K1&K2**
2.	apply experimental techniques to determine optical constants, resistance, EMF, and magnetic field intensity in laboratory conditions.	**K3**
3.	analyze data from spectroscopic and electrical experiments to determinephysical properties such as Rydberg's constant, temperature coefficients, and magnetic moments.	**K4**
4.	evaluate sources of error in precision measurements and propose improvements to experimental methodologies.	**K5**
5.	create models and experimental setups based on fundamental physics principles.	**K6**

K1–Remember; **K2**–Understand; **K3**–Apply; **K4**–Analyse; **K5**–Evaluate; **K6**–Create

Unit	Experiment / Topic	Teaching Hours	Assessment Hours	Cognitive Level	Pedagogy	Student-Centric Methods	E-Resources	Assessment / Evaluation Methods
1	Spectrometer – (i-d) curve	4	1	K1 & K2	Demonstration, Inquiry-Based Learning	Hands-on instrument handling, Observation recording	NPTEL Optics, MIT OCW Physics	Lab performance, Graph accuracy, Viva, Model Exam
2	Spectrometer – (i-i′) curve	4	1	K2 & K3	Experiential Learning	Angle measurement practice, Peer discussion	HyperPhysics, Khan Academy (Optics)	Curve plotting, Error analysis, Viva
3	Spectrometer – Cauchy's constant	4	1	K3	Problem-Based Learning	Data collection & curve fitting	NPTEL Optics lectures	Calculation accuracy, Lab record, Model Exam
4	Spectral response of photoconductor (LDR)	4	1	K3	Activity-Based Learning	Real-time measurement, Group experimentation	PhET Simulations (Light & Waves)	Graph interpretation, Viva, Observation skills
5	Potentiometer – Resistance & Specific resistance	4	1	K3	Inquiry-Based Learning	Circuit setup, Measurement comparison	NPTEL Electrical Measurements	Circuit accuracy, Numerical results, Viva
6	Potentiometer – Calibration of voltmeter	4	1	K4	Analytical Learning	Error detection, Calibration	MIT OCW (Instrumentation)	Calibration report, Error analysis

						comparison		
7	Potentiometer – EMF of thermocouple	3	1	K4	Experiential Learning	Temperature vs EMF observation	NPTEL Thermal Physics	Graph plotting, Interpretation, Viva
8	Carey Foster's Bridge – Temperature coefficient	3	1	K4	Constructivist Approach	Resistance comparison tasks	NPTEL Electrical Circuits	Calculation accuracy, Lab record
9	Deflection Magnetometer – Magnetic moment & BH	4	1	K4 & K5	Demonstration + Inquiry	Field measurement, Group analysis	NPTEL Magnetism	Result accuracy, Viva, Model Exam
10	Vibration Magnetometer – BH (Tan B position)	4	1	K5	Analytical Learning	Time period measurement, Peer evaluation	MIT OCW (Magnetism)	Error evaluation, Viva
11	Thermo EMF (M.G method)	3	1	K4	Activity-Based Learning	Temperature variation study	NPTEL Thermodynamics	Graph, Report submission
12	High resistance by leakage (Ballistic Galvanometer)	3	1	K5 & K6	Project-Based Learning	Circuit design, Troubleshooting	NPTEL Experimental Physics	Experimental setup, Innovation, Viva

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Employability, Skill Development

Activities (Em / En /SD): Hands on Training , Project

Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): NIL

Environment Sustainability activities related to Cross Cutting Issues: NIL

Sample questions

1. Plot the *(i–d)* curve using a spectrometer and determine the angle of minimum deviation for the given prism.
2. Determine Cauchy's constants for the material of the prism using spectrometer readings and analyze the variation of refractive index with wavelength.
3. Calibrate the given high-range voltmeter using a potentiometer and compare the measured values with standard readings.
4. Determine the EMF of a thermocouple using a potentiometer and plot the variation of thermo EMF with temperature.
5. Using Carey Foster's bridge, determine the temperature coefficient of resistance of the given wire and evaluate possible sources of error.
6. Determine the magnetic moment of a bar magnet and the horizontal component of Earth's magnetic field using a deflection magnetometer. Suggest improvements to increase accuracy.

Head of the Department

Dr. S. Sonia, Dr. M. Priya Dharshini & Dr.A. Lesly Fathima

Course Instructors

Department : Physics
Class : III B.Sc. Physics
Title of the Course : CORE LAB COURSEVIII: GENERAL PHYSICS LAB VIII
Semester : VI
Course Code : PU236CP2

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU235CP2	-	-	2	-	1	2	30	25	75	100

Learning Objectives:

1. To perform basic experiments on characteristics of electronic devices and then get into the applications such as amplifiers, oscillators, multivibrators.
2. To analyse the functioning of Logic gates and ICs and understand their applications.

Course Outcomes

On the successful completion of the course, students will able to:		
1.	recall the basic concepts of transistors, diodes and operational amplifiers	**K1&K2**
2.	design and analyze operational amplifier-based circuits such as differentiators, integrators, inverting, non-inverting, summing, adder, and subtractor circuits	**K3**
3.	implement and verify Boolean expressions and demonstrate NAND as a universal gate using logic gates	**K3**
4.	construct and analyze diode-based clipping and clamping circuits.	**K3**
5.	examine the characteristics of a transistor in CE and CB configurations.	**K4**

K**1**–Remember**; K2**–Understand**; K3-**Apply**; K4-**Analyze

Total Contact hours: 30 (Including Practical Classes and Assessments)

Unit	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
1	Operational amplifier-differentiator & integrator	4	1	K1& K2	Inquiry-Based Learning, Project-Based Learning	Hands-on Breadboarding	"Digital Electronics" & "Analog Circuits" by Prof. Anant Agarwal, Prof. S.C. Dutta Roy https://nptel.ac.in	Rubric-Based Evaluation- Circuit accuracy, waveform correctness, concept explanation, teamwork, Model Exam
2	Operational amplifier-inverting amplifier and summing.	4	1	K3	Peer Teaching, Reciprocal Learning, Reciprocal method	Group Activity, Think-Aloud Protocol	Digital Logic Design Lecture series https://ocw.mit.edu	Project based Evaluation, Model Exam
3	NAND as universal building block.	4	1	K3	Blended Learning, Demonstration method	Hands-on circuit construction and real-time experimentation		Oral Q&A ,Troubleshooting questions, Model Exam
4	Verification of Boolean Expression	4	1	K3	Constructivist Pedagogy, Activity-Based Learning	Peer Teaching (exchanging roles during circuit building),	NPTEL: Digital Circuits by Prof. S. C. Dutta Roy, Logic	Viva on truth table, logic equations, Circuit functionality test, Model Exam.

						Think-Pair-Share (for truth table generation and circuit design)	circuit simulation, Interactive logic gate simulations, YouTube: All About Electronics, Ekeeda	
5	Decoder	5		K4	Experiential Learning, Inquiry-Based Pedagogy	Circuit Debugging Challenge, Peer Learning through group tasks	NPTEL: Analog Circuits by Prof. S. Janakiraman, YouTube: Electronics Hub, EEVblog	Pre-lab quiz on timing formula T=1.1RC, Oscilloscope waveform verification, Viva on IC 555 pin configuration, Lab report with circuit diagram and calculated vs observed timing, Peer evaluation on troubleshooting skills, Model Exam
6	Op-amp: Adder and Subtractor	4	1		Project-Based Learning, Problem-Based Learning	Group brainstorming & presentation	NPTEL: Digital Systems by Prof.	Functional circuit evaluation, Report on priority encoder logic, Oral

							Dinesh Patel, YouTube: Gate Smashers, Electronics Tutorials	presentation on real-world encoder uses, Concept-based MCQs on encoders and decoders, Model Exam

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Employability, Skill Development

Activities (Em / En /SD): Hands on Training , Project

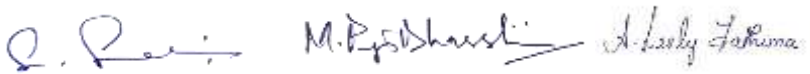
Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): NIL

Environment Sustainability activities related to Cross Cutting Issues: NIL

Sample questions

1. Verify the Universality of NAND gate.
2. Verify the given Boolean expression using Logic gates.
3. Construct a decoder circuit and verify the truth Table.
4. Construct the inverting amplifier using IC741 and verify their experimental and theoretical gains.
5. Construct the differentiator and integrator and form the waveforms for them.
6. Design and verify the Adder and Subtractor using Operational amplifier.

Head of the Department



Dr. S. Sonia, Dr. M. Priya Dharshini & Dr.A. Lesly Fathima

Course Instructors

Department : Physics
Class : III B.Sc. Physics
Title of the Course : CORE LAB COURSE IX: GENERAL PHYSICS LAB IX (C++PROGRAMMING)
Semester : VI
Course Code : PU236CP3

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PU235CP2	-	-	2	-	1	2	30	25	75	100

Learning Objectives:

1. To apply object oriented programming techniques to solve physics problems.
2. To develop programs using functions and classes (objects, array of objects, friend functions, passing and returning objects).

Course Outcomes

On the successful completion of the course, students will able to:		
1.	understand the principles of object oriented program to construct computer programs and modeling of experimental data for the solution of problems in physics.(period of a pendulum and Young's modulus of a material).	**K1&K2**
2.	apply object oriented programming techniques to solve computing problems. (addition, subtraction, multiplication and division)	**K1&K2**
3.	develop programs using functions and classes.(objects, array of objects, friend functions, passing and returning objects, function declaration with/without using the return statement).	**K2&K3**
4.	Formulate the applications of pointers and virtual functions. Distinguish formatted and unformatted I/O operations.	**K3&K4**
5.	develop programs using constructor, destructor, operator overloading and inheritance. (generate a series of Fibonacci numbers using constructor in the scope of class definition/out of the class definition using the scope resolution operator).	**K4&K5**

K**1**–Remember**; K2**–Understand**; K3-**Apply**; K4-**Analyze; **K5** - Evaluate

Total Contact hours: 30 (Including Practical Classes and Assessments)

Unit	Topic	Teaching Hours	Assessment Hours	Cognitive level	Pedagogy	Student Centric Method	E-Resources	Assessment/ Evaluation Methods
1	To read any two numbers through the keyboard and to perform simple arithmetic operation (addition, subtraction, multiplication and division) and display the results using Cinand Coutfunctions. Use do-while loop	4	1	K1& K2	Inquiry-Based Learning, Project-Based Learning	Program debugging	Online C++ tutorial websites	Rubric-Based Evaluation- concept explanation, teamwork, Model Exam
2	To display the name of the day in a week, depending upon the number entered through key board using Switch-Case statement	4	1	K1& K2	Peer Teaching, Reciprocal Learning, Reciprocal method	Group Activity, Think-Aloud Protocol	-	Project based Evaluation, Model Exam

3	To find the sum of the series using for loop. • Sum=1+3+5+ .....n • Sum=1+ 22+42+..... +n 2	4	1	K2&K3	Blended Learning, Demonstration method	Write algorithm and flowchart in groups		Oral Q&A, Model Exam
4	To read the elements of the given two matrices of order mx n and to perform the matrix addition and display the transpose of the result.	4	1	K3&K4	Constructivist Pedagogy, Activity-Based Learning	Pair programming & debugging exchange	Interactive coding platforms	Program- Written test
5	To write a LOOP programme to find the period of a pendulum of given length L, in a gravitational field. Accept the required values using the keyboard. Also display the result.	5		K4&K5	Experiential Learning, Inquiry-Based Pedagogy	Program Debugging Challenge, Peer Learning through group tasks	-	Pre-lab quiz on Programs
6	To generate a series of Fibonacci numbers using constructor where the construct or member function has been defined in the scope of class definition/ out of	4	1		Project-Based Learning, Problem-Based Learning	Group brainstorming & presentation	-	Model Exam

	the class definition using the scope resolution operator.							

Course Focussing on Employability/ Entrepreneurship/ Skill Development: Employability, Skill Development

Activities (Em / En /SD): Hands on Training , Project

Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): NIL

Environment Sustainability activities related to Cross Cutting Issues: NIL

Sample questions

1. Read any two numbers through the key board and to perform simple arithmetic operation (addition, subtraction, multiplication and division) and display the results using C in and C out functions. Use do-while loop. Verify the given Boolean expression using Logic gates.
2. Display the name of the day in a week, depending upon the number entered
3. To find the sum of the series using for loop.
   a) Sum = 1 + 3 + 5 + ……. n
   b) Sum = x – x 3 /3! + x 5 /5! - x 7 /7! + ……x n /n!
   c) Sum = $1 + 2^2 + 4^2 + \ldots\ldots\ldots\ldots + n^2$
4. Read the elements of the given two matrices of order m x n and to perform the matrix addition and display the transpose of the result.
5. Write a program to find the period of a pendulum of given length L, in a gravitational field. Accept the required values using the keyboard. Also display the result.
6. Generate a series of Fibonacci numbers using constructor where the constructor member function has been defined in the scope of class definition / out of the class definition using the scope resolution operator.

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