Holy Cross College (Autonomous), Nagercoil

Kanyakumari District, Tamil Nadu.

Accredited with A^{+} by NAAC - IV cycle – CGPA 3.35

Affiliated to

Manonmaniam Sundaranar University, Tirunelveli

DEPARTMENT OF PHYSICS

TEACHING PLAN

EVEN SEMESTER 2024 -2025

DEPARTMENT OF PHYSICS

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.

Programme Educational Objectives (PEOs)

PEOs	Upon completion of B.A/B.Sc. degree programme, the graduates will be able to	Mission addressed
PEO 1	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**
PEO 2	inculcate practical knowledge for developing professional empowerment and entrepreneurship and societal services.	**M2, M3, M4 & M5**
PEO 3	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
PSO - 1	understand the core theories and principles of physics which include mechanics, thermodynamics, electronics, material science etc.	**PO1**
PSO - 2	develop extensive comprehension of fundamental and diverse applications of Physics.	**PO2 & PO3**
PSO - 3	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**
PSO - 4	analyze the observed experimental data and relate the results with theoretical expectations. Communicate appropriately and effectively, in a scientific context using present technology.	**PO6**
PSO - 5	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: Heat, Thermodynamics and Statistical Physics

Semester: II

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, student 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	Topics	Teaching hours	Cognitive Level	Pedagogy	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	K1(R)	Lecture using chalk and talk, Discussion with Videos, mind mapping using	Evaluation through: Quiz using QUIZZIZ,

					TASKADE, Demonstration	Problem Solving
	2	Joly's method for determination of C_V – Regnault's method for determination of C_P	4	K2(U)	Lecture using STEVE.AI, Problem solving	short questions
	3	Joule-Kelvin effect – porous plug experiment – Joule-Thomson effect	4	K2(U)	Demonstration, PPT using SLIDESPILOT, Problem solving, Review	Descriptive answers
	4	Boyle temperature – temperature of inversion – liquefaction of gas by Linde's Process – adiabatic demagnetisation.	4	K2(U)	Demonstration, Peer tutoring, Problem solving, Review	
II	**Thermodynamics-I**					
	1	Zeroth law and first law of thermodynamics	3	K1(R)	Demonstration, Peer tutoring, Problem solving, Review Discussion with FLIP, mind mapping using TASKADE	Evaluation through: Quiz using GOOGLE FORM, short questions
	2	P-V diagram – heat engine – efficiency of heat engine	4	K3(Ap)	Demonstration, Peer tutoring, Problem solving, Review, Discussion with PPT using SLIDESPILOT, mind mapping using TASKADE	Descriptive answers Problem solving

	3	Carnot's engine, construction, working	3	K1(R)	Demonstration, Peer tutoring, Problem solving, Review, mind mapping using TASKADE	Formative assessment (II CIA)
	4	efficiency of petrol engine and diesel engines – comparison of engines	5	K3(Ap)	Demonstration, Peer tutoring, Problem solving, Review	
III	**Thermodynamics-II**					
	1	Second law of thermodynamics –entropy of an ideal gas – entropy change in reversible and irreversible processes	4	K2(U)	Lecture using chalk and talk, Discussion with video, mind mapping using TASKADE	Evaluation through: MENTIMETER, short questions Descriptive answers Formative assessment (I & II CIA)
	2	T-S diagram –thermodynamical scale of temperature	3	K3(Ap)	Lecture using videos, Problem solving	
	3	Maxwell's thermodynamical relations – Clasius-Clapeyron's equation (first latent heat equation)	4	K2(U)	Lecture using videos, Demonstration, Peer tutoring, Problem solving, Review.	
	4	Third law of thermodynamics – unattainability of absolute zero – heat death.	4	K3(Ap)	Demonstration, Peer tutoring, Problem solving, Review	
IV	**Heat Transfer**					
	1	Modes of heat transfer: conduction, convection and radiation	2	K2(U)	Lecture using videos, mind mapping using TASKADE	Evaluation through: short test Class Test Multiple choice questions
	2	Thermal conductivity – determination of thermal conductivity of a good conductor by Forbe's method – determination of thermal conductivity of a bad	5	K2(U)	Lecture using videos, Problem solving	

		conductor by Lee's disc method.				Quiz using SLIDO Formative assessment Short Summary or Overview (II CIA)
	3	Radiation: black body radiation (Ferry's method) – distribution of energy in black body radiation – Wien's law and Rayleigh Jean's law	4	K3(Ap)	Demonstration, Peer tutoring, Problem solving, Review	
	4	Planck's law of radiation – Stefan's law – deduction of Newton's law of cooling from Stefan's law.	4	K3(Ap)	Demonstration, Peer tutoring, Problem solving, Review	
V	**Statistical Mechanics**					
	1	Definition of phase-space – micro and macro states – ensembles –different types of ensembles	3	K2(U)	Lecture using chalk and talk, Discussion with PPT, mind mapping using TASKADE	Evaluation through: short test Class Test Multiple choice questions Quiz Formative assessment Short Summary or Overview (II CIA)
	2	Classical and quantum Statistics – Maxwell Boltzmann statistics – expression for distribution function	5	K3(Ap)	Demonstration, Problem solving	
	3	Bose-Einstein statistics – expression for distribution function	3	K3(Ap)	Demonstration, Peer tutoring, Problem solving, Review.	
	4	Fermi-Dirac statistics – expression for distribution function – comparison of three statistics.	4	K3(Ap)	Demonstration, Peer tutoring, Problem solving, Review.	

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

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 227^{o}C and 15^{o}C. **(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. C. NIRMALA LOUIS, M.Sc., Ph.D., PGDCA
Head & Assistant Professor,
PG & Research Department of Physics,
Holy Cross College (Autonomous),
Nagercoil, Kanyakumari District,
Tamil Nadu, PIN: 629 004.

Head of the Department: Dr. C. Nirmala Louis

Course Instructor : Dr. A. Lesly Fathima & Dr. P. Aji Udhaya

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	Cognitive level	Pedagogy	Assessment/ Evaluation
I	1.	Interference – interference in thin films –colors of thin films – air wedge – determination of diameter of a thin wire by air wedge	4	K1(R)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping,	Evaluation through: short test Class Test Quiz through Quizziz Formative assessment through Hot Potatoes
	2.	diffraction – diffraction of light vs sound – normal incidence	4	K1(R)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	
	3.	experimental determination of wavelength using diffraction grating (no theory) – polarization	3	K2(U)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping,	
	4.	polarization by double reflection – Brewster's law – optical activity – application in sugar industries	4	K2(U)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	
II	5.	Atom models – Bohr atom model – mass number – atomic number – nucleons – vector atom model	4	K1(R)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping	Evaluation through: short test Class Test Multiple choice questions Quiz through Nearpod Formative assessment through
	6.	various quantum numbers – Pauli's exclusion principle – electronic configuration – periodic classification of elements – Bohr magneton	4	K1(R)	Peer tutoring, Lecture using videos, Problem solving, Derivation, PPT, Review	
	7.	Stark effect – Zeeman effect (elementary ideas only) – photo electric effect – Einstein's	3	K2(U)	Lecture using Chalk and talk ,Introductory session, Group	

		photoelectric equation			Discussion, Mind mapping,	Mentimetre
	8	applications of photoelectric effect: solar cells, solar panels, optoelectric devices	4	K2(U)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	
III	9	Nuclear models – liquid drop model – magic numbers – shell model – nuclear energy – mass defect – binding energy – radioactivity – uses – half life – mean life - radio isotopes and uses	3	K2(U)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping,	Evaluation through: short test Class Test
	10	controlled and uncontrolled chain reaction – nuclear fission – energy released in fission – chain reaction – critical reaction – critical size- atom bomb – nuclear reactor	4	K2(U)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	Match the following through Hot Potatoes
	11	breeder reactor – importance of commissioning PFBR in our country – heavy water disposal, safety of reactors: seismic and floods	4	K3(Ap)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping,	
	12	introduction to DAE, IAEA – nuclear fusion – thermonuclear reactions – differences between fission and fusion.	4	K3(Ap)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	Formative assessment through Quizziz
IV	13	Frame of reference – postulates of special theory of relativity – Galilean transformation equations	4	K3(Ap)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping	Evaluation through: short Class Test
	14	Lorentz	3	K3(Ap)	Peer tutoring,	

		transformation equations – derivation – length contraction – time dilation			Lecture using videos, Problem solving, Derivation, PPT	Multiple choice questions Quiz through Slido Formative assessment through Nearpod
	15	– twin paradox – mass-energy equivalence – introduction on gravitational waves	4	K4(An)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping,	
	16	LIGO, ICTS opportunities at International Centre for Theoretical Sciences	4	K4(An)	Peer tutoring, Lecture using videos, Problem solving, Derivation, PPT, Review	
V	17	p-n junction diode – forward and reverse biasing – characteristic of diode – zener diode	4	K4(An)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Derivation	Evaluation through: short Class Test Multiple choice questions Quiz Formative assessment through Hot Potatoes
	18	characteristic of zener diode – voltage regulator – full wave bridge rectifier	4	K4(An)	Peer tutoring, Lecture using videos, Problem solving, PPT,	
	19	construction and working – advantages (no mathematical treatment) – USB cell phone charger	3	K5(E)	Lecture using Chalk and talk ,Derivation, Group Discussion, Mind mapping,	
	20	introduction to e-vehicles and EV charging stations	4	K5(E)	Peer tutoring, Lecture using videos, Problem solving, PPT	

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. C. NIRMALA LOUIS, M.Sc., Ph.D., PGDCA.
Head & Assistant Professor,
PG & Research Department of Physics.
Holy Cross College (Autonomous),
Nagercoil. Kanyakumari District,
Tamil Nadu. PIN: 629 004.

Dr. C. Nirmala Louis
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	Cognitive level	Pedagogy	Assessment/Evaluation
I	**PHOTOGRAPHY AND BASIC PRINCIPLE OF IMAGE FORMATION**					
	1	Principle – chemical route and digital route –light, wavelengths, colours –	**2**	K2(U)	Demonstration,	Evaluation through: Online quiz using Slido and Nearpod, short questions, ,

		shadows				MCQ, True/False, Short essays
	2	light intensity and distance – making light form images	**2**	K2(U)	PPT, illustration, blended classroom	
	3	pin-hole images – practical limitations to pin-hole images – lens instead of pin-hole	**1**	K2(U)	PPT, Illustration, flipped classroom	
	4	focal length and image size – imaging of closer subjects.	**1**	K2(U)	PPT, blended classroom	
II	**LENSES – CONTROLLING THE IMAGES**					
	1	Photographic lens – focal length and angle of view (problems)	**2**	K3(Ap)	PPT, Group Discussion, blended classroom	Evaluation through: Online quiz through slido and nearpod, Short questions Descriptive answers Formative assessment I
	2	focusing movement – aperture and f-numbers (problems)	**2**	K3(Ap)	PPT, Group discussion	
	3	depth of field– depth of focus – image stabilization	**1**	K2(U)	Concept Explanation, Theoretical formulation	
	4	lenses for digital cameras – lens and camera care	**1**	K2(U)	Demonstration, Group Discussion, Flipped classroom	
III	**CAMERA USING FILMS AND ITS TYPES**					
	1	Camera and its essential components– shutter – aperture – light measurement – film housing	**2**	K2(U)	Lecture	

					method, Concept Explanation, Peer group learning, PPT	Evaluation through: Online Quiz through slido and nearpod, short questions Descriptive answers MCQ, True/False, Concept explanations, Formative assessment I/II
	2	– camera types: view camera– view finder camera – camera types: view camera– view finder camera	**2**	K4(An)	Illustration, flipped classroom Theoretical formulation Group Discussion	
	3	Reflex camera– single lens reflex (SLR) camera	**2**	K2(U)	Group discussion, blended classroom, PPT	
IV	**DIGITAL CAMERAS PRINCIPLE AND TYPES**					
	1	Principle of digital image capturing – comparison of digital and analog picture information – megapixel – grain, noise and pixel density	**2**	K2(U)	Lecture method, Peer group learning, PPT	Evaluation through: Online quiz through slido and nearpod, short questions Descriptive answers MCQ, True/False, Concept explanations, Short
	2	optical and digital zooming – image stabilizer – bit depth – white balance – colour modes – file formats (TIFF, RAW & JPEG) – storage cards and types	**2**	K2(U)	Lecture method, group discussion, PPT	

	3	digital cameras: camera phones – compact camera – hybrid camera – digital SLR	**2**	K2(U)	Group discussion, PPT	Summary Formative assessment II
V	**THE DIGITAL IMAGE – POSTPRODUCTION**					
	1	Hardware: computer and its peripherals – software: saving digital file – basic editing: navigating the image – undo/redo/history – crop – rotate – brightness & contrast – colour balance – hue/saturation – dodge/burn	**2**	K2(U)	Lecture method, Peer group learning, PPT	Evaluation through: Online quiz through slido and nearpod short questions Descriptive answers MCQ, True/False, Concept explanations,
	2	cloning & amp; retouching – removing an element in an image – advanced editing: histogram/levels – curves	**2**	K2(U)	Lecture method, Peer group learning, PPT	
	3	selection tools: magic wand – printing digital images: inkjet printer – laser printer – dye sub printer – lambda/ light jet printers.	**2**	K2(U)	Lecture method, Peer group learning, PPT	Formative assessment 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)

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. C. NIRMALA LOUIS, M.Sc., Ph.D., PGDCA
Head & Assistant Professor,
PG & Research Department of Physics,
Holy Cross College (Autonomous),
Nagercoil, Kanyakumari District,
Tamil Nadu. PIN: 629 004.

Head of the Department **Course Instructor**

Dr. C. Nirmala Louis **Dr. R. Krishna Priya**

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
PU231NM1	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	Cognitive level	Pedagogy	Assessment/Evaluation
I	**SCIENTIFIC STUDY OF MUSIC**					
	1	vibrations of atoms of matter– vibrations coupling to air	**2**	K2(U)	Demonstration,	Evaluation through: Online quiz using QuizaliceAI, short questions, , MCQ, True/False, Short essays
	2	propagation of sound waves in air, other media, fluids & solids	**2**	K2(U)	PPT, illustration, blended classroom	

	3	velocity, frequency, wavelength, time period, intensity: definition and unit fs – classification of sound on frequency and velocity	**1**	K2(U)	PPT, Illustration, flipped classroom	
	4	human & animal sound perception– mechanism of ear and hearing – psychoacoustics	**1**	K2(U)	PPT, blended classroom	
II	**SIMPLE VIBRATING SYSTEMS**					
	1	Simple harmonic motion – tuning fork	**2**	K2(U)	PPT, Group Discussion, blended classroom	Evaluation through: Online quiz through slido and nearpod, Short questions Descriptive answers Formative assessment I
	2	amplitude, phase, energy, energy loss/damping/ dissipation – power – travelling waves and standing waves	**2**	K2(U)	PPT, Group discussion	
	3	laws of vibration in stretched strings– one-dimensional medium – open and closed organ pipes	**1**	K2(U)	Concept Explanation, Theoretical formulation	
	4	over tones, harmonics – quality of sound: pitch, timber, loudness – octaves, musical notes	**1**	K2(U)	Demonstration, Group Discussion, Flipped classroom	
III	**MUSICAL TONE**					

	1	pure/simple tones – sine/cosine waves– well-defined frequencies, wavelengths, amplitudes & phases	**2**	K2(U)	Lecture method, Concept Explanation, Peer group learning, PPT	Evaluation through: Online Quiz through slido and Quizalice AI, short questions Descriptive answers MCQ, True/False, Concept explanations, Formative assessment I/II
	2	partial tones – assembly of pure tones– mix of different frequencies & amplitudes– complex tone – superposition of simple tones	**2**	K2(U)	Illustration, flipped classroom Theoretical formulation Group Discussion	
	3	complex waveform– periodic complex waveform – formants – resonances– sound envelope	**2**	K2(U)	Group discussion, blended classroom, PPT	
IV	**PRODUCTION OF MUSICAL SOUNDS**					
	1	human voice,mechanism of vocal sound production – larynx (sound box)	**2**	K2(U)	Lecture method, Peer group learning, PPT	Evaluation through: Online quiz through nearpod, short questions Descriptive answers MCQ, True/False, Concept explanations, Short
	2	stringed Instruments:plucked &bowed, guitar,	**2**	K2(U)	Lecture method, group discussi	

		mandolin, violin, piano, etc. – wind instruments: whistles, flute, saxophone, pipe organ, bag pipes,etc			on, PPT	
	3	percussion instruments, electronic instruments, analog and digital sound synthesizers	**2**	K2(U)	Group discussion, PPT	Summary Formative assessment II
V	**RECORDING OF MUSIC & SOUND**					
	1	Edison phonograph – cylinder & disk records – magnetic wire and tape recorders – digital recording	**2**	K1(R)	Lecture method, Peer group learning, PPT	Evaluation through: Online quiz through slido and nearpod short questions Descriptive answers MCQ, True/False, Concept explanations, Formative assessment II
	2	analog transducers, condenser, dynamic microphones, loudspeaker – complex sound fields	**2**	K1(R)	Lecture method, Peer group learning, PPT	
	3	digital signal processing – digital filtering – specifications of recording studios	**2**	K1(R)	Lecture method, Peer group learning, PPT	

Course Focussing on Employability/ Entrepreneurship / Skill Development:

Employability

Activities (Em/ En/SD): **Exhibition on types of musical instruments and their working**

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

Activities related to Cross Cutting Issues: **Album making- Simple harmonic motion**

Assignment: (Mention Topic and Type): **Mechanism of ear and hearing - descriptions through Google Classroom**

Seminar Topic: (if applicable): -

Sample questions (minimum one question from each unit)

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

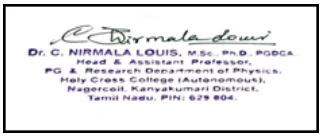
Part B (4 marks)

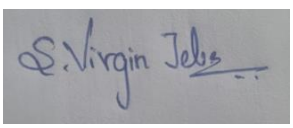
1. Write short notes on propagation of sound waves in air **(K2-U, CO-1)**
2. Write the difference between traveling waves and standing waves **(K2-U, CO-2)**
3. Explain the sine and cosine waves? **(K2-U, CO-3)**
4. Explain the mechanism of vocal sound production. **(K2-U, CO-4)**
5. How did Edison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

Head of the Department **Course Instructor**





Dr. C. Nirmala Louis **Dr. S. Virgin Jeba**

Teaching Plan

Department: Physics

Class: II B.Sc. Physics

Title of the Course: 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

On the successful completion of the course, student will be able to**:**		
1	outline basic knowledge of methods of rectifying different defects in lenses, articulate technological applications of eyepieces.	**K1**
2	understand the wave nature of light through working of interferometer.	**K2**
3	apply the knowledge of nature of light through diffraction techniques and apply mathematical principles to analyse the optical instruments.	**K3**
4	categorise basic formulation of polarization and appraise its usage in industries.	**K4**
5	evaluate the principles of optics to various fields of IR, Raman and UV spectroscopy and understand their instrumentation and application in industries	**K5**

Teaching Plan

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

Unit	Module	Topics	Teaching hours	Cognitive Level	Pedagogy	Assessment/ Evaluation
I	**Lens and Prisms**					
	1	Lens maker's formula – Equivalent focal length of two thin lenses separated by a distance.	3	K1(R)	Lecture using chalk and talk, Discussion with Videos, Demonstration	Evaluation through: Quiz using QUIZZIZ,

	2	Aberrations: Spherical aberration in a lens – Methods of minimizing Spherical aberration-condition for minimum spherical aberration – Chromatic aberration.	5	K1(R)	Lecture using STEVE.AI, Problem solving, mind mapping using TASKADE	Problem Solving short questions
	3	Prism: Dispersion, deviation, Achromatic combination of Prisms	3	K1(R)	Demonstration, PPT using SLIDESPILOT, Review	Descriptive answers
	4	Dispersion without deviation –Deviation without dispersion – applications – Direct vision spectroscope.	4	K1(R)	Demonstration, Peer tutoring, Problem solving, Review	
II	**Interference**					
	1	Division of wave front – Fresnel's biprism – fringes with white light ,	3	K2(U)	Demonstration, Peer tutoring, Problem solving, Review Discussion with FLIP.	Evaluation through: Quiz using GOOGLE FORM,
	2	Division of amplitude: interference in thin films due to reflected light - transmitted light	4	K2(U)	Discussion with PPT using SLIDESPILOT, mind mapping using TASKADE	short questions
	3	Air wedge – Newton's rings. Michelson's interferometer – applications	3	K2(U)	Demonstration, Peer tutoring, Problem solving, Review.	Descriptive answers
	4	Determination of the wavelength of a monochromatic source of light, determination of the wavelength and separation D1 and D2 lines of sodium light.	5	K2(U)	Demonstration, Peer tutoring, Problem solving, Review	Problem solving Formative assessment (II CIA)
III	**Diffraction**					

	1	Fresnel's assumptions – zone plate – action of zone plate for an incident spherical wave front –	4	K3(Ap)	Lecture using chalk and talk, Discussion with video, mind mapping using TASKADE	Evaluation through: MENTIMETER, short questions Descriptive answers Formative assessment (I & II CIA)
	2	Differences between a zone plate and a convex lens –	3	K3(Ap)	Lecture using videos, Problem solving	
	3	Fresnel type of diffraction – diffraction pattern due to a straight edge– Fraunhofer type of diffraction – Fraunhofer diffraction at a single slit –	4	K3(Ap)	Lecture using videos, Demonstration, Peer tutoring, Problem solving, Review.	
	4	Plane diffraction grating– experiment to determine wavelengths.	4	K3(Ap)	Lecture using STEVE.AI, Demonstration, Peer tutoring, Problem solving, Review	
IV	**POLARISATION**					
	1	Polarizer and analyser – double refraction – optic axis, principal plane	3	K4(An)	Lecture using chalk and talk, Discussion with Videos, Demonstration	Evaluation through: Quiz using QUIZZIZ, Problem Solving short questions Descriptive answers
	2	Huygens's explanation of double refraction in uniaxial crystals	4	K4(An)	Lecture using STEVE.AI, Problem solving, mind mapping using TASKADE	
	3	Polaroids and applications – Circularly and elliptically polarized light – quarter wave plate – half wave plate	4	K4(An)	Demonstration, PPT using SLIDESPILOT, Review	

	4	Production and detection of circularly and elliptically polarized lights – Fresnel's explanation.	4	K4(An)	Demonstration, Peer tutoring, Problem solving, Review	
V	**SPECTROSCOPY**					
	1	Infra-red spectroscopy-Near infra-red and far infra-red – Properties –	3	K5(E)	Demonstration, Peer tutoring, Problem solving, Review Discussion with FLIP.	Evaluation through: Quiz using GOOGLE FORM, short questions Descriptive answers Problem solving Formative assessment (II CIA)
	2	IR source- IR Detectors -IR spectrophotometer – applications -Scattering of light	4	K5(E)	Discussion with PPT using SLIDESPILOT, mind mapping using TASKADE	
	3	Raman effect - Experimental study of Raman effect –applications – Ultraviolet and visible spectroscopy	4	K5(E)	Demonstration, Peer tutoring, Problem solving, Review.	
	4	properties – UV source – UV Detectors- Spectrographs for UV regions- Applications	4	K5(E)	Demonstration, Peer tutoring, Problem solving, Review	

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

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: Correction Lens

Sample Questions

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)**

Dr. C. NIRMALA LOUIS, M.Sc., Ph.D., PGDCA
Head & Assistant Professor,
PG & Research Department of Physics,
Holy Cross College (Autonomous),
Nagercoil. Kanyakumari District,
Tamil Nadu. PIN: 629 004.

Dr. C. Nirmala Louis

Head of the Department:

Dr. S.J. Jenepha Mary& Dr. P. Aji Udhaya

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**

Modules

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/Evaluation
I	**OPTICS:**					
	1	Interference – interference in thin films – colours of thin films – air wedge	**3**	K1(R)	Lecture using chalk and talk, Introductory session, Group discussion Mind mapping	Evaluation through: short test, Class test, Multiple choice Questions, Quiz, Formative assessment, Shorts Summary or Overview
	2	Determination of diameter of a thing wire by air wedge – diffraction normal incidence	**3**	K2(U)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	
	3	Experimental determination of wavelength using diffraction grating (no theory) - polarization	**3**	K3(Ap)	Lecture using chalk and talk, Introductory session, Group discussion Mind mapping	
	4	Polarization by double refraction – Brewster's law – optical activity – Appliction in sugar industry	**3**	K1(R)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	
II	**ATOMIC PHYSICS:**					
	1	Atom models – Bohr atom model – mass number – atomic number – nucleons – vector atom model – various quantum numbers	**4**	K1(R)	Lecture using chalk and talk, Introductory session, Group discussion Mind mapping	Evaluation through: short test, Class test, Multiple choice Questions, Quiz, Formative assessment
	2	Pauli's exclusion principle – electronic configuration – periodic classification of elements.	**4**	K2(U)	Peer tutoring, Lecture using videos, Problem solving, Demonstration PPT, Review	
	3	Stark effect – Zeeman effect (elementary ideas only) – photo electric	**4**	K3(Ap)	Lecture using chalk and talk, Introductory session, Group discussion	

		effect – Einstein's photoelectric equation.			Mind mapping	
III	**NUCLEAR PHYSICS:**					
	1	Nuclear models – liquid drop model – shell model – magic numbers	**4**	K1(R)	Lecture using chalk and talk, Introductory session, Group discussion Mind mapping	Evaluation through: short test, Class test, Multiple choice Questions, Quiz, Formative assessment, Shorts Summary or Overview
	2	Nuclear energy – mass defect – binding energy curve – Natural radioactivity – half-life – mean life	**4**	K1(R)	Peer tutoring, Lecture using videos, Problem solving, Demonstration PPT, Review	
	3	Nuclear fission and fusion – comparison – energy released in fission – thermonuclear reactions	**4**	K2(U)	Lecture using chalk and talk, Introductory session, Group discussion Mind mapping	
IV	**NUCLEAR REACTORS:**					
	1	Chain reaction – Controlled chain reaction – uncontrolled chain reaction – Atom bomb	**4**	K1(R)	Lecture using chalk and talk, Introductory session, Group discussion Mind mapping	Evaluation through: short test, Class test, Multiple choice Questions, Quiz, Formative assessment, Shorts Summary or Overview
	2	Nuclear reactor – Construction and Working – breeder reactor - types	**4**	K1(R)	Peer tutoring, Lecture using videos, Problem solving, DemonstrationPPT, Review	
	3	Introduction to Department of atomic energy	**4**	K2(U)	Lecture using chalk and talk,	

		(DAE) – International atomic energy agency (IAEA)			Introductory session, Group discussion Mind mapping	
V	**SEMICONDUCTOR PHYSICS:**					
	1	P-N junction diode – forward and reverse biasing – characteristic of diode	**4**	K1(R)	Lecture using chalk and talk, Introductory session, Group discussion Mind mapping	Evaluation through: short test, Class test, Multiple choice Questions, Quiz, Formative assessment, Shorts Summary or Overview
	2	Zener diode – Characteristic of Zener diode – voltage regulator	**4**	K3(Ap)	Peer tutoring, Lecture using videos, Problem solving, DemonstrationPPT, Review	
	3	USB cell phone charger – Introduction to e-vechicles and EV charging stations	**4**	K2(U)	Lecture using chalk and talk, Introductory session, Group discussion Mind mapping	

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)

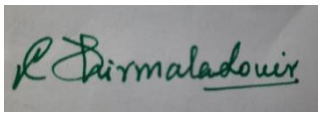
1. The phenomenon of superposition of two coherent waves in the region of superposition is **(K1-R, CO-1)**
   (a)Reflection (b) refraction (c) polarization (d) interference
2. No two electrons in an atom exist in the same quantum state. State True / False **(K3-Ap, CO-2)**
3. _____ is the difference 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)**



Head of the Department

S. Sebastiammal

Dr. Sr. S. Sebastiammal

Course Instructor

Teaching Plan

Department : Physics
Class : III B.Sc. Physics
Title of the Course : Major Core VIII: Relativity and Quantum Mechanics
Semester : VI

Course Code : PC2061

Hours/Week	Credits	Total Hours	Marks
6	5	90	100

Learning Objectives

1. To acquire sufficient knowledge in the concept of Relativity, dual nature of matter waves,
2. To apply the Quantum mechanics principles, Operator formalisms and derive Schrodinger equation and its applications.

Course Outcome

COs	Upon completion of this course, students will be able to:	PSO addressed	CL
CO - 1	gain knowledge in the concepts of special and theory of relativity	PSO - 1	K2(U)
CO - 2	evolve ideas about dual nature of matter	PSO - 2	K5(E)
CO - 3	recognize basic terms in Quantum Mechanics and different operator mechanism	PSO - 3	K6(C)
CO - 4	apply of Schrödinger's equation to micro system	PSO - 4	K3(Ap)

Teaching Plan

Total contact hours: 90 (Including lectures, assignments and Tests)

Unit	Module	Topics	Lecture hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**Relativity**:					
	1	Frames of reference - Galilean transformation.	4	K2(U)	Lecture, discussion PPT, blended eaching	Multiple Choice Questions Quiz through slido and nearpod, Formative Assessment I Assignment
	2	Michelson-Morley experiment -Postulates of special theory of relativity	3	K3(Ap)	Lecture demonstration PPT	
	3	Lorentz transformation - length Contraction – time dilation - Relativity of simultaneity - addition of velocities	5	K3(Ap)	Lecture demonstration PPT	
	4	Variation of mass with velocity– Mass energy relation - Elementary ideas of general relativity.	3	K4(An)	PPT Lecture discussion	
II	**Wave Theory:**					
	1	Wave Nature of Matter Phase and group velocity.	3	K1(R)	PPT Lecture discussion	Multiple Choice Questions Quiz through slido and nearpod, Formative Assessment I
	2	Wave packet - expression of De Brogile's wave length.	4	K2(U)	PPT Lecture discussion	
	3	Davisson and Germer's experiment - G.P.Thomson's experiment.	5	K4(An)	PPT Lecture	

	4	Heisenberg's uncertainty principle and its consequences.	3	K2(U)	Lecture PPT	
III	**Fundamentals of quantum mechanics:**					
	1	Schrodinger Equation Inadequacy of classical mechanics - Basic postulates of quantum mechanics.	4	K1(R)	Lecture, PPT, blended classroom	Multiple Choice Questions Quiz through slido and nearpod, Formative Assessment I & II
	2	Schrodinger equation - Properties of wave function - Probability interpretation of wavefunction.	5	K2(U)	Lecture PPT	
	3	Linear operators - self adjoint operators .	3	K2(U)	Lecture PPT	
	4	Expectation value - eigenvalues and eigenfunctions - commutativity and compatibility.	3	K5(E)	Lecture PPT	
IV	**Operators:**					
	1	Angular Momentum in Quantum Mechanics Orbital angular momentum operators and their commutation relations.	5	K5(E)	Lecture discussion, PPT	Multiple Choice Questions Quiz through slido and nearpod, Formative Assessment II
	2	Separation of three dimensional Schrodinger equation into radial and angular parts	5	K3(Ap)	Lecture discussion, PPT	
	3	Elementary ideas of spin angular momentum of an electron - Pauli matrices.	5	K4(An)	Lecture discussion, PPT	
V	**Applications of Schrodinger Equation:**					

	1	Solutions of Schrodinger Equation – Time dependent and time independent Schrodinger equation.	5	K6(C)	Lecture discussion, PPT	Multiple Choice Questions Quiz through slido and nearpod, Formative Assessment II
	2	Free particle solution - Particle in a box - Potential well of finite depth (one dimension).	5	K6(C)	Lecture discussion, PPT	
	3	Linear harmonic oscillator - rigid rotator and hydrogen atom.	5	K6(C)	Group discussion, PPT	

Course Focussing on Employability/ Entrepreneurship/ Skill Development : Entrepreneurship

Activities (En):Problem solving in relativity.

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

Activities related to Cross Cutting Issues :-

Assignment : Elementary ideas of general relativity.

Seminar Topic: -

Sample questions (minimum one question from each unit)

Part A

1.The laws of Physics are same in all inertial frame of reference. (State True/False)**(K2-U, CO-1)**

2. Choose the correct De Broglie wavelength of a 46 gm gold ball moving with velocity 36m/m. **(K5-E, CO-2)**

a) $4x10^{-34}$ m b) $5x10^{-34}$ m c) $4x10^{-32}$ m d) $5x10^{-32}$ m

3. For a dispersive medium in the case of de Broglie waves, the condition for group and phase velocity is, **(K5-E, CO-2)**

a) $v_g < v_D$ b) $v_g > v_D$ c) $v_g = v_D$ d) none of these

4. Angular momentum is the rotational analog of linear momentum. State True / False

5. Atomic hydrogen constitutes about 75% of the -------- mass of the universe.

a) nuclear b) hydrogen c) baryonic d) thermal

Part – B

6. State and explain the postulates of general theory of Relativity. **(K2-U, CO-1)**

7. Calculate the de Broglie wavelength of the charge particle of charge q and accelerated through the potential V. **(K5-E, CO-2)**

8. State and explain the general postulates of quantum mechanics. **(K2-U, CO-1)**

9. Write short note on Pauli matrices. **(K2-U, CO-1)**

10.Apply Schrodinger equation and find out the energy of a particle in a box having Infinite Square well potential. **(K3-Ap, CO-4)**

Part – C (5 x 8 = 40)

1. Explain in brief about the Michelson-Morley experimental setup and interpret the negative result. **(K2-U, CO-1)**

2. Derive a relation connecting group and phase velocity. **(K5-E, CO-2)**

3. Give a detailed account on linear operators and self adjoint operators. **(K2-U, CO-1)**

4. Separate three dimensional Schrodinger equation into radial and angular parts. **(K3-Ap, CO-4)**

5. Apply Schrodinger equation and find out the energy and wave function of a Linear Harmonic Oscillator. **(K3-Ap, CO-4)**

Dr. C. NIRMALA LOUIS, M.Sc., Ph.D., PGDCA
Head & Assistant Professor,
PG & Research Department of Physics,
Holy Cross College (Autonomous),
Nagercoil, Kanyakumari District,
Tamil Nadu, PIN: 629 004.

Dr.C.Nirmala Louis

Head of the Department

Dr.M.Abila Jeba Queen & Dr. V.Virgin Jeba

Course Instructors

Teaching Plan

Department : Physics
Class : III B.Sc. Physics
Title of the Course : Core IX- Digital and Communication Electronics
Semester : VI
Course Code : PC2062

Hours/Week	Credits	Total Hours	Marks
6	5	90	100

Learning Objectives

1. To understand the structure of various number system and basic Logic gates.
2. To design and solve the Boolean Algebra simplification and Karnaugh Maps.
3. To construct sequential circuits and to design counters.

Course Outcomes

COs	Upon completion of this course, students will be able to:	PSO addressed	CL
CO -1	Understand the basic operation, and features related to Logic gates and interprets their applications.	**PSO-1**	**K2(U)**
CO -2	Acquire knowledge on number system, arithmetic building blocks, and memories.	**PSO-3**	**K5(E)**
CO -3	Understand the fundamental concepts of logic gates, counters, registers, fiber optics, etc.	**PSO-1**	**K2(U)**
CO -4	Develop skill to build and troubleshoot combinational digital circuits.	**PSO-7**	**K3(Ap)**
CO-5	Understand AM, FM and PM modulation and demodulation techniques.	**PSO-1**	**K2(U)**
CO-6	Assess the basic concepts of fiber optics and types of fiber diodes, transistor, op-amps and converters.	**PSO-2**	**K5(E)**
CO-7	Learn the working principle of satellite communication system.	**PSO-6**	**K6(C)**

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

Modules

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

Unit	Module	Topics	Lecture hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**Digital Fundamentals**					
	1	Number Systems and Conversions - Binary-Coded Decimal (BCD) Code - Gray code - 1's and 2's complements	6	K3(Ap)	Lecture discussion with PPT illustration	Evaluation through short test Multiple choice questions Formative assessment I
	2	Basic logic gates - NAND, NOR and EX-OR gates - NAND and NOR as Universal Building blocks - Laws and theorems of Boolean algebra	5	K5(E)	Lecture discussion with illustration	
	3	NAND-NAND circuits - Karnaugh's map- Sum of Product (SOP) and Product of Sum (POS) - applications	4	K3(Ap)	Lecture discussion	
II	**Sequential Logic**					
	1	RS-Flip flop, Clocked RS Flip flop, D-Flip flop, J-K and J-K Master-Slave Flip-flop	6	K2(U)	Lecture discussion with PPT Illustration	Short test Quiz Assignment Formative assessment I
	2	Shift registers and Counters - Multiplexers and Demultiplexers	4	K3(Ap)	Lecture discussion	
	3	Decoders and Encoders - Memory Circuits - D/A and A/D converters - applications	5	K3(Ap)	Lecture Illustration	
III	**Modulation and Demodulation**					

	1	Amplitude modulation - Frequency modulation, Phase Modulation and Pulse Width Modulation -	5	K2(U)	Lecture with PPT Illustration	Short test Quiz Assignment Formative assessment I
	2	Detectors of Amplitude Modulation (AM), Frequency Modulation (FM)	4	K2(U)	Lecture discussion	
	3	Phase modulation (PM) and Pulse width modulation (PWM), Phase locked loop (PLL) - Noise in Communication Systems.	6	K2(U)	Question-answer session Lecture	
IV	**Digital and Satellite Communication**					
	1	Amplitude Shift Keying (ASK), Frequency Shift Keying (FSK), Phase Shift Keying (PSK) Modulation and Demodulation, Advantages and disadvantages of digital communication.	3	K2(U)	Lecture with PPT Illustration	Short test Quiz Assignment Formative assessment II
	2	Communication Satellite Systems - Telemetry - Tracking and Command System- Satellite Links	6	K2(U)	Lecture Discussion	
	3	Commonly Used frequency in Satellite Communication - Multiple access - Error Detection.	6	K2(U)	Question-answer session Lecture	
V	**Fibre Optic Communication**					
	1	Basic Fibre Optic System - Advantages of Fibre Optic System	6	K5(E)	Lecture with PPT	Short test Quiz Assignment

		- Propagation of light through fibre				Formative assessment II
	2	Numerical aperture - Acceptance angle - Losses and distortion in optical fibres	5	K5(E)	Brain storming session. Lecture Illustration	
	3	Basic Fibre Optical communication and links - Special applications	4	K5(E)	Lecture with PPT Illustration	

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

Activities (Em/ En/SD): **Project works based on electronics (Skill Development)**

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

Sustainability/ Gender Equity): **-**

Activities related to Cross Cutting Issues: -

Assignment: (Mention Topic and Type): **Problem Solving in Digital Fundamentals on code conversion**

Seminar Topic: (if applicable): **Basic Fibre Optic Communication System**

Sample questions (minimum one question from each unit)

Part A (1 mark)

1. A number code that uses only the digits 0 and 1 to represent quantities **(K3- Ap, CO-4)**
   a) Binary Number b) Octal number
   c)decimal number d) Hexadecimal number
2. If J=1, K=1 in a JK flip flop and input clock frequency is 2MHz, the Q-output frequency will be_____**(K3- Ap, CO-4)**
   a) 2MHz b) 1MHz c) 0.5MHz d) 4MHz
3. The abbreviation for PLL is _____ **(K2- U, CO-5)**
4. The minimum number of communication satellites used for simultaneous worldwide communication is **(K2- U, CO-1)**
   a. 1 b. 2 c. 3 d. 4
5. The principle used for the transmission of light signals through the optical fiber is……. **(K5- E, CO-6)**
   a. Reflection b. Refraction
   c. Diffraction d. Total internal reflection

Part B (4 marks)

1. State and Prove De - Morgan's theorems. **(K3- Ap, CO-4)**
2. What is 'racing Problem' with the J-K flip flop? How it can be avoided? **(K2- U, CO-3)**
3. Explain the term Pulse width modulation. **(K2- U, CO-5)**
4. Explain the following terms **(K2- U, CO-1)**
   i. up-link ii. Down-link iii Cross-link
5. Calculate the velocity of light in the optically active region of a substance at 850nm and at 1300nm. Also compute the corresponding wavelength. Given: Refractive index of the substance at 850nm = 3.6 and at 1300nm =3.4. Velocity of light in free space= 3×10^8 m/s. **(K5- E, CO-6)**

Part C (8 marks)

1. Draw a NOR-NOR circuit for this Boolean expression. **(K5- E, CO-2)**
   Y= (A'+B'+C') (A'+B+C') (A+B+C')
2. How would you implement the RS flip flop using NAND gates? Sketch the timing diagram of the RS flip flop? **(K3- Ap, CO-4)**
3. Draw the block diagram of earth station and explain the various units in it. **(K2- U, CO-5)**
4. Elucidate amplitude and frequency modulation. **(K2- U, CO-1)**
5. Derive an expression for numerical aperture and acceptance angle in optical fibers. **(K5- E, CO-6)**

Dr. C. NIRMALA LOUIS, M.Sc., Ph.D., PGDCA.
Head & Assistant Professor,
PG & Research Department of Physics.
Holy Cross College (Autonomous),
Nagercoil. Kanyakumari District,
Tamil Nadu. PIN: 629 004.

Head of the Department **Course Instructor**

Dr. C. Nirmala Louis **Dr. M.Priya Dharshini & Dr. R. Krishna Priya**

Department : Physics

Class : III B.Sc. Physics

Course Name : Nuclear Physics

Course Code : PC2063

Semester : VI

No of hours per week	No of credits	Total no of hours	Marks
5	5	75	100

Learning Objectives

1. To enable the students to understand the properties, models and radioactive reaction of the nucleus.
2. To create awareness on nuclear reactions such as fission, fusion, radiation detectors and elementary particles so that students can shine.

CO	Upon completion of this course the students will be able to :	PSO addressed	CL
CO- 1	gain knowledge on the fundamentals of nuclear matter (properties of nuclei and Nuclear forces)	PSO-2	R
CO- 2	apply the principles of physics in the measurements of Nuclear size, Nuclear spin, Nuclear energy levels and Nuclear magnetic moment	PSO-1	Ap
CO- 3	Study the various nuclear reactions (nuclear fission and fusion)	PSO-3	E
CO -4	explain the decay modes, Radiation Detectors and Particle Accelerators (Ionisation chamber, Proportional counter, Geiger Muller counter, Linear accelerator, Cyclotron, Synchrocyclotron, Betatron)	PSO-5	U
CO- 5	discuss the classification of elementary particles and Quark model	PSO-5	E
CO -6	analyze the characteristics and behavior of elementary particles and their fundamental interactions	PSO-7	An
CO -7	develop a deeper understanding of some important applications of nuclear physics in Nuclear Reactor and Source of stellar energy.	PSO-6	C

Modules

Total contact hours: 75 (Including lectures, assignment and tests)

Unit	Section	Topics	Lecture Hours	Learning outcomes	Pedagogy	Assessment/Evaluation
I	**Properties of Nuclei**					
	1	Constituents of nuclei - Isotopes, Isobars, Isotones and	**4**	Define the basis of nuclei and stability of nucleus	PPT using Gamma with AI, Lecture discussion	Evaluation: Slido, Class test, oral question Assignment

		mirror nuclei - Nuclear mass and binding energy - Unit of atomic mass - Binding energy and stability of nucleus				I
	2	Mass defect and packing fraction - Binding fraction Vs mass number curve - Nuclear size - Nuclear spin - Nuclear energy levels	**4**	Apply various Binding energy relations	Derivation and group discussion	
	3	Nuclear magnetic moment - Parity of nuclei - Nuclear quadrupole moment - Statistics of nuclei	**4**	solution of Nuclear magnetic moment	Derivation, problem solving and group discussion	
	4	Nuclear forces - Liquid drop model - Semi-empherical mass formula - Shell model	**3**	Apply Nuclear forces in different models	PPT using Gamma with AI, Derivation and group discussion	
II	**Radioactivity**					
	1	Radioactivity - Radioactive reactions - Radioactive decay law - Statistical nature of radioactivity	**3**	Solve Radioactive reactions	PPT using Gamma with AI ,Derivation discussion	Evaluation: Slido, Class test, oral question Assignment I/II
	2	Activity or strength of a radio-sample - Radioactive	**4**	Define and derive Radioactive decay	Derivation and group discussion problem	

		decay : Conservation laws			solving	
	3	Radioactive series: Displacement law - Successive transformation – Radioactive equilibrium	**4**	Statement and proof of displacement law	Derivation and group discussion problem solving	
	4	Radioactive dating: Age of minerals, rocks - Alpha decay - Beta decay - Gamma decay.	**4**	Radioactive dating and its applications	PPT using Gamma with AI ,Derivation and group discussion problem solving	
III	**Nuclear Reactions**					
	1	Nuclear Reactions: Basics - Conservation laws in nuclear Reactions - Energetics of nuclear Reactions	**3**	Analyse Conservation laws in nuclear Reactions	PPT using Gamma with AI Derivation discussion	Evaluation: Slido, Class test, oral question Assignment II
	2	Cross section of nuclear Reactions - Reaction mechanisms - Nuclear fission - Energy released in fission of U-235	**4**	Define and derive nuclear Reactions , Reaction mechanisms &Nuclear fission	Derivation and group discussion	
	3	Liquid drop theory of fission - Nuclear chain reaction - Nuclear Reactor - Types of reactor - Breeder reactor - Fission	**4**	Define and Derive Nuclear chain reaction, Types of reactor, Breeder reactor &	Derivation and group discussion, PPT using Gamma with AI	

		bomb		Fission bomb		
	4	Fusion: Thermo nuclear reaction - Source of stellar energy: Natural fusion - Uncontrolled fusion: Hydrogen bomb.	**4**	Define, derive and apply Uncontrolled fusion: Hydrogen bomb	Derivation and group discussion, PPT using Gamma with AI	
IV	**Radiation Detectors and Particle Accelerators**					
	1	Introduction - Ionisation chamber - Proportional counter - Geiger Muller counter - Neutron detection	**4**	Discuss different types of Radiation Detectors	Derivation discussion	Evaluation Slido, Class test, oral question Assignment II/III
	2	Cloud chamber - Scintillation counter - Photographic detection - Solid state track detector	**3**	Define and derive Cloud chamber & Scintillation counter	Derivation and group discussion, PPT using Gamma with AI	
	3	Semiconductor detector - Particle accelerators - Linear accelerator	**4**	Define and Derive different types of Particle accelerators	Derivation and group discussion	
	4	Cyclotron - Synchro cyclotron - Betatron	**4**	Define , derive and apply Cyclotron , Synchro cyclotron and Betatron	PPT using Gamma with AI ,Derivation and group discussion	
V	**Elementary Particles**					
	1	Introduction - Fundamental Interactions - Pions and Muons - K mesons –	**4**	Analyse Fundamental Interactions	Discussion PPT using Gamma with AI	Evaluation: Slido, Class test, oral question Assignment **III**

		Hyperons, Antiparticles				
	2	Classification of elementary particles - Conservation laws - CPT theorem	**4**	Analyse classification of elementary particles	Derivation and group discussion, PPT using Gamma with AI	
	3	Resonance particles - Symmetry classification of elementary particles	**3**	Explain symmetry classification of elementary particles	Derivation and group discussion, PPT using Gamma with AI	
	4	Quark model Unification of interactions - The standard model.	**4**	Define , derive and apply Quark model	Derivation and group discussion, PPT using Gamma with AI	

Course Focussing on Employability/ Entrepreneurship/ Skill Development : Employability

Activities (SD): Model Making

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

Activities related to Cross Cutting Issues:-

Assignment : Seminar Topic: - Classification of elementary particles

Sample questions (minimum one question from each unit)

Part A

1. Nuclei with half integral spin obey _____.

   a) MB statistics b) FD statistics c) BE statistics d) FB statistics

2. 1 Curie of radioactivity is given by

   a) 3.7×10^{10} disint /min b) 3.7×10^{10} disint /hour c) 3.7×10^{10} disint /sec d) none of these

3. For an inelastic nuclear collision the Q value is

   a) $Q>0$ b) $Q<0$ c) $Q=0$ d) *infinite*

4. In linear accelerators the drift tube lengths are progressively increasing in the ratio of

   a) 1: 2: 3 b) 1: 3: 5 c) $\sqrt{1} : \sqrt{2} : \sqrt{3}$ d) $\sqrt{1} : \sqrt{5} : \sqrt{7}$

5. Neutrons comes under ---------- classification of elementary particles.

   a) hadrons b) hyperons c) mesons d) leptons

Part B

1. Define binding energy and packing fraction of nuclei. How does the binding energy per nucleon vary with mass number for light, medium and heavy nuclei? **(K3-Ap, CO-5)**
2. Derive an expression for Half-life and average life value of a radioactive substance. **(K5-E, CO-4)**
3. State and prove the conservation laws in nuclear reactions **(K4-An, CO-3)**
4. Discuss the principle and construction of Cloud chamber. **(K4-An, CO-3)**
5. Explain the classification of elementary particles and its properties. **(K2-U, CO-1)**

Part – C

1. Describe Rutherford's experiment on the scattering of α particles and state some of the important conclusions drawn from the experiment. Give briefly the theory of scattering. **(K2-U, CO-1)**
2. Explain how the phenomenon of radioactivity can be applied for the determination of the age of the earth **(K4-An, CO-3)**
3. Define nuclear fission. Find out the energy released in fission of U-235? Discuss the construction and working of Breeder reactor. **(K5-E, CO-4)**
4. Elucidate the principle, construction and working of Synchro Cyclotron. Hence deduce the frequency of revolution of the particles. **(K4-An, CO-3)**

5. What are quarks?. Describe the quark model of elementary particles. Also discuss the quark content of some of baryons and mesons. **(K1-R, CO-2)**

Dr.C.Nirmala Louis
Head of the Department

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

Teaching Plan

Department : Physics
Class : III B.Sc Physics
Title of the Course : Elective III (b) Nano Physics
Semester : VI
Course Code : PP2065

Hours /Week	Credits	Total hours	Marks
5	4	75	100

Learning Objectives

1. To gain knowledge on synthesis and characterization of nanomaterials.
2. To understand the advancements and applications of nanostructures.

Course Outcome

COs	Upon completion of this course, students will be able to:	PSO addressed	CL
CO - 1	infer the history of nanotechnology and explain the synthesis of nanomaterials.	**PSO - 1**	**U**
CO - 2	interpret quantum well, quantum wires and quantum dots.	**PSO - 5**	**E**
CO - 3	explain the carbon nanotubes and its applications.	**PSO - 6**	**E**
CO - 4	discuss the applications of nanotechnology in various fields.	**PSO - 4**	**C**

Modules

Total contact hours: 90 (Including lectures, assignment and tests)

Unit	Section	Topics	Lecture Hours	Cognitive Level	Pedagogy	Assessment/Evaluation
I	**Nanomaterials**					
	1	History of Nanotechnology - Background -	3	K1(R)	Lecture Discussion with PPT	

		Conceptual origins - Experimental advances - Nanostructures			Illustration	
	2	Nanomaterials - Synthesis of oxide nanoparticles- Sol-gel processing - Synthesis of semiconductor nanoparticles	3	K2 (U)	Lecture discussion	Evaluation through: Online quiz using Slido Formative assessment I
	3	Arrested precipitation - Synthesis of metallic nanoparticles	3	K2 (U)	PPT Illustration (using nearpod)	
	4	Sonochemical reduction process - Electrochemical deposition method - Biosynthesis of nanoparticles	3	K2 (U)	Lecture discussion	
II	**Quantum Hetero structure**					
	1	Super lattice - Preparation of Quantum nanostructure - Quantum well lasers	3	K2 (U)	PPT and group Discussion	Evaluation through: Online quiz, Short questions Descriptive answers Formative assessment I
	2	Quantum cascade laser - Application - Quantum wire - production of nanowires	3	K3 (Ap)	Lecture Discussion with PPT Illustration	
	3	Structure of nanowires - Use of nanowires -	3	K4 (An)	PPT Illustration	

		Quantum dot - Application of Quantum dots				
	4	Quantum dot information storage - Quantum dot infrared photo detectors - Quantum dot lasers	3	K5 (E)	Lecture Discussion with PPT Illustration	
III	**Carbon Nanotubes**					
	1	Discovery of Nanotubes - Carbon Allotropes - Diamond - Graphite - Carbon Nanotubes	3	K2 (U)	Lecture discussion	Evaluation Evaluation through: Online quiz, Short questions Descriptive answers Formative assessment I/II
	2	Types of carbon Nanotubes- Single walled carbon nanotubes - Multiwalled carbon nanotube - Fullerite - Torus - Nanobuds	3	K3 (Ap)	Lecture Discussion with PPT Illustration	
	3	Graphene sheet to a single walled nanotube - Electronic structure of Carbon Nanotubes	3	K4 (An)	Lecture discussion	
	4	Synthesis of Carbon Nanotube - Electric Arc Discharge method - Laser method.	3	K5 (E)	PPT and group Discussion	
IV	**Magneto Electronics**					
	1	Nanocrystalline soft material - Permanent magnet material	3	K2 (U)	Lecture Discussio n with PPT Illustratio	Evaluation through: Online quiz, Problem solving short questions Descriptive

					n	answers Formative assessment II
	2	Theoretical background - Super paramagnetism - Coulomb blockade	3	K3 (Ap)	Lecture discussion	
	3	Quantum cellular Automata- Spintronics	3	K4 (An)	PPT Illustration	
	4	Giant magneto resistance (GMR) - Types of GMR.	3	K5 (E)	Lecture Discussion with PPT Illustration	
V	**Application of Nanotechnology**					
	1	Chemistry and Environment - Energy applications of nanotechnology	3	K2 (U)	PPT Illustration	Evaluation through: Online quiz (Slido), Problem solving short questions Descriptive answers Formative assessment II
	2	Information and Communication - Heavy Industry – Consumer goods	3	K3 (Ap)	Lecture Discussion with PPT Illustration	
	3	Nanomedicine - Medical application of Nanotechnology - Biomarkers and Bioimaging	3	K6 (C)	Lecture discussion	

	4	Targeted drug delivery - Nanorobots.	3		PPT Illustration	

PO- Program outcome; LO – Learning outcome; Cognitive Level R – Remember; U – Understand; Ap- Apply, An- Analyze; E-Evaluate; C- Create

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

Activities (Em/ En/SD): **Project**

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

Activities related to Cross Cutting Issues :Nil

Assignment : (Mention Topic and Type): **Applications of nanoparticles in medicine - Google Classroom**

Seminar Topic: (if applicable): -

Part A (1 mark)

1. Red blood cells are _____ in diameter. **(K2- U, CO-1)**
2. Lasers containing more than one quantum well layer are known as _____ . **(K5- E, CO-2)**
3. Cylindrical fullerenes are called as _____. **(K5- E, CO-3)**
4. Spintronics is also called as _____ **(K6- C, CO-4)**
   a) Microelectronics b) Magnetoelectronics c) Nanoelectronics d) None
5. Nanorobots could harvest power directly from the _____. **(K6- C, CO-4)**
   a) Bloodstream b) Nuclear power source c) Optical systems d) vibrating membranes

Part B (3 marks)

1. Describe the approaches used in nanotechnology for synthesizing nanomaterials. **(K2-U, CO-1)**
2. Summarize the applications of Quantum dot laser. **(K5-E, CO-2)**
3. Compare Electric arc discharge method with laser method for the fabrication of CNTs.

   (K5-E, CO-3)

4. Hypothesize in detail about the permanent magnetic material. **(K6-C, CO-4)**
5. Write and explain the energy applications of nanoparticles. **(K6-C, CO-4)**

Part C (7 marks)

1. Describe sol-gel method for synthesizing nanomaterials. **(K2- U, CO-1)**
2. Summarize the growth, properties and applications of quantum cascade laser.**(K5-E, CO-2)**
3. Discriminate single walled CNTs with multiwalled CNTs. **(K5-E, CO-3)**
4. Create Giant magneto resistance and explain its types.**(K6-C, CO-4)**
5. Explain the functioning of targeted drug delivery and the factors influencing the drug Delivery. (**K6-C, CO-4)**

Dr. C. NIRMALA LOUIS, M.Sc., Ph.D., PGDCA.
Head & Assistant Professor,
PG & Research Department of Physics.
Holy Cross College (Autonomous),
Nagercoil. Kanyakumari District,
Tamil Nadu. PIN: 629 004.

S. Sebastiammal

Head of the Department

Dr. S. Sonia & Dr. S. Sebastiammal
Course Instructors