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

ODD SEMESTER 2024 -2025

Vision

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

Mission

- To produce competent graduates infused with professionalism, ethical values andsocial 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.

PG PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEOs	Upon completion of M. Sc. Physics Programme, the graduates will be able to:	Mapping with Mission
PEO1	apply scientific and computational technology to solve social and ecological issues and pursue research.	**M1, M2**
PEO2	continue to learn and advance their career in industry both in private and public sectors.	**M4 & M5**
PEO3	develop leadership, teamwork, and professional abilities to become a more cultured and civilized person and to tackle the challenges in serving the country.	**M2, M5 & M6**

PG PROGRAMME OUTCOMES (POs)

POs	Upon completion of M.Sc. Physics Degree Programme, the graduates will be able to:	Mapping with PEOs
PO1	apply their knowledge, analyze complex problems, think independently, formulate and perform quality research.	**PEO1 & PEO2**
PO2	carry out internship programmes and research projects to develop scientific and innovative ideas through effective communication.	**PEO1, PEO2 & PEO3**
PO3	develop a multidisciplinary perspective and contribute to the knowledge capital of the globe.	**PEO2**
PO4	develop innovative initiatives to sustain ecofriendly environment	**PEO1, PEO2**
PO5	through active career, team work and using managerial skills guide people to the right destination in a smooth and efficient way.	**PEO2**
PO6	employ appropriate analysis tools and ICT in a range of learning scenarios, demonstrating the capacity to find, assess, and apply relevant information sources.	**PEO1, PEO2 & PEO3**
PO7	learn independently for lifelong executing professional, social and ethical responsibilities leading to sustainable development.	**PEO3**

PROGRAMME SPECIFIC OUTCOMES (PSOS)

PSO	Upon completion of M.Sc. Physics Degree Programme, the graduates of Physics will be able to:	Mapping with POs
PSO1	have well– defined knowledge on theoretical concepts and experimental methods of advanced physics.	**PO1 & PO2**
PSO2	acquire skills in performing advanced physics experiments and projects using modern technology and numerical simulations.	**PO3, PO4 & PO5**
PSO3	develop and communicate analytical skills ranging from nuclear to cosmology to progress in the expanding frontiers of physics.	**PO6**
PSO4	apply and interpret physics principles in various physical observations. Demonstrate proficiency in analyzing, applying and solving Scientific problems.	**PO1, PO7**
PSO5	use the techniques, skills, and modern technology necessary to communicate effectively with professional and ethical responsibility. Understand the impact of Physics in a global, economic, environmental, and societal context.	**PO7**

Teaching Plan

Department : Physics
Class : I M.Sc. Physics
Title of the Course : Core: I Mathematical Physics
Semester : I
Course Code : PP231CC1

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PP231CC1	7	-	-	-	5	7	105	25	75	100

Objectives

- To equip students with the mathematical techniques needed for understanding theoretical treatment in different courses taught in their program.
- To extend their manipulative skills to apply mathematical techniques in their fields.
- To help students apply Mathematics in solving problems of Physics.

Course outcomes

CO	Upon completion of this course, students will be able to:	PSO addressed	Cognitive level
CO-1	Understand use of bra-ket vector notation and explain the meaning of complete orthonormal set of basis vectors, and transformations and be able to apply them.	PSO - 3	K1(R) & K2(U)
CO-2	Able to understand analytic functions, do complex integration, by applying Cauchy Integral Formula. Able to compute many real integrals and infinite sums via complex integration.	PSO - 2	K2(U) & K3(Ap)
CO-3	Analyze characteristics of matrices and its different types, and the process of diagonalization.	PSO - 1	K4(An)
CO-4	Solve equations using Laplace transform and analyze the Fourier transformations of different function, grasp how these transformations can speed up analysis and correlate their importance in technology.	PSO - 2	K4(An) & K5(E)
CO-5	To find the solutions for physical problems using linear differential equations and to solve boundary value problems using Green's function. Apply special functions in computation of solutions to real world problems.	PSO - 1	K2(U) & K5(E)

Teaching plan

Total Contact hours: 105 (Including lectures, assignments and tests)

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**Linear Vector Space**					
	1.	Basic concepts – Definitions- examples of vector space – Linear independence .	4	K2(U)	Introductory session, Lecture using Chalk and talk , PPT.	Evaluation through short test, MCQ, True/False, Short essays.
	2.	Scalar product- Orthogonality – Gram-Schmidt orthogonalization procedure –linear operators – Dual space- ket and bra notation	6	K1(R)	Lecture using Chalk and talk , PPT,Discussion , Mind mapping,	Concept definitions, MCQ.
	3.	orthogonal basis – change of basis – Isomorphism of vector space – projection operator	6	K3(Ap)	Lecture using Chalk and talk, PPT.	Evaluation through short test, MCQ, True/False, Explain Principle.
	4.	Eigen values and Eigen functions –	3	K5(E)	Problem solving.	Evaluation through Problem solving
	5.	Direct sum and invariant subspace – orthogonal transformations and rotation.	6	K4(An)	Lecture using Chalk and talk , Problem Solving, PPT.	Evaluation through Problem solving Definition.
II	Complex analysis					
	1.	Review of Complex Numbers -de Moivre's theorem.	3	K2(U)	Introductory session, Lecture	Evaluation through short

					using Chalk and talk , PPT.	test, MCQ, True/False, Short essays.
	2.	Complex Variable- Differentiability - Analytic functions- Harmonic Functions.	3	K4(An)	Problem solving, Demonstration.	Statements, MCQ, Problem solving .
	3.	Functions of a Complex Integration- Contour Integration, Cauchy – Riemann conditions – Singular points .	5	K5(E)	Problem solving , Mind mapping,	Evaluation through short test, MCQ, True/False, Problem solving.
	4.	Cauchy's Integral Theorem and integral Formula -Taylor's Series - Laurent's Expansion- Zeros and poles	5	K5(E)	Lecture using Chalk and talk , Problem Solving, PPT.	Evaluation through short test, Long derivation, Problem solving.
	5.	Residue theorem and its Application: Potential theory - (1) Electrostatic fields and complex potentials - Parallel plates, coaxial cylinders and an annular region (2) Heat problems - Parallel plates and coaxial cylinders.	5	K3(Ap)	Lecture using Chalk and talk , Problem Solving, PPT.	Evaluation through Problem solving .
III	Matrices					
	1.	Types of Matrices and their properties, Rank of a Matrix .	5	K5(E)	Lecture using Chalk and talk , discussion, Derivation.	Evaluation through short test, Concept definitions, MCQ.
	2.	Conjugate of a matrix - Adjoint of a matrix - Inverse of a matrix.	3	K5(E)	Lecture , discussion , PPT, Problem Solving	Concept definitions, MCQ, Problem Solving.

	3.	Hermitian and Unitary Matrices -Trace of a matrix- Transformation of matrices.	3	K4(An)	Lecture using Chalk and talk , , Derivation.	Evaluation through short test, MCQ, True/False, Problem Solving .
	4.	Characteristic equation - Eigen values and Eigen vectors.	5	K5(E)	Problem solving,	Evaluation through Problem Solving .
	5.	Cayley–Hamilton theorem – Diagonalization.	5	K5(E)	Group Problem Solving	Evaluation through Problem Solving
IV	Fourier Transforms and Laplace Transforms					
	1.	Definitions -Fourier transform and its inverse.	3	K1(R)	Lecture using Chalk and talk , discussion, Derivation.	Evaluation through short test, MCQ, True/False, Problem Solving .
	2.	Transform of Gaussian function and Dirac delta function - Fourier transform of derivatives - Cosine and sine transforms - Convolution theorem.	5	K5(E)	Lecture , discussion , PPT, Problem Solving	Evaluation through Problem Solving.
	3.	Application: Diffusion equation: Flow of heat in an infinite and in a semi - infinite medium - Wave equation: Vibration of an infinite string and of a semi - infinite string.	4	K3(Ap)	Lecture using Chalk and talk , discussion, Problem Solving.	Evaluation through Definition, MCQ, Problem Solving
	4.	Laplace transform and its inverse - Transforms of	2	K5(E)	Lecture using Chalk and talk , discussion, Derivation.	Long Derivations, MCQ, Problem

		derivatives and integrals .				Solving
	5.	Differentiation and integration of transforms - Dirac delta functions .	3	K5(E)	Lecture , discussion , PPT, Derivation.	Long Derivations, MCQ, Problem Solving
	6.	Application - Laplace equation: Potential problem in a semi - infinite strip.	4	K3(Ap)	Lecture , discussion , PPT, Derivation.	Long Derivations, MCQ, Problem Solving
V	Differential Equations					
	1.	Second order differential equation- Sturm-Liouville's theory .	4	K2(U)	Lecture discussion, PPT	Evaluation through Definition, MCQ, Problem Solving.
	2.	Series solution with simple examples - Hermite polynomials - Generating function - Orthogonality properties - Recurrence relations	4	K3(Ap)	Lecture using Chalk and talk , d Problem Solving , Derivation.	Evaluation through Definition, MCQ, Problem Solving
	3.	Legendre polynomials - Generating function - Rodrigue formula – Orthogonality properties	4	K5(E)	Lecture discussion, PPT, Problem Solving	Longer essay, MCQ, Problem Solving
	4.	Dirac delta function- One dimensional Green's function and Reciprocity theorem	4	K5(E)	Lecture using Chalk and talk , discussion, Derivation.	Evaluation through Definition, MCQ, Problem Solving .
	5.	Sturm-Liouville's type equation in one dimension & their Green's function.	5	K5(E)	Group discussion, PPT, Problem Solving	Evaluation through Definition, MCQ, Problem Solving .

Course Focussing on Employability/ Entrepreneurship/ Skill Development : Employability
Activities (Employability): Hands on Training on Problem solving using software.

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

Activities related to Cross Cutting Issues :-

Assignment : State and derive the Generating function of the Hermite polynomials.

Seminar Topic: Problem solving in FT and LT

Sample questions (minimum one question from each unit)

Part A

1. State the difference between ket and bra notation (K2)
2. How to find the Singular points at Z=0? (K3)
3. Check the hermitian condition of 2x3 matrix. (K4)
4. Apply the Transform of Gaussian function. (K5)
5. State one dimensional greens theorem. (K2)

Part B

6. State and derive Gram-Schmidt orthogonalization procedure. (K2)
7. State and prove Cauchy's integral theorem. (K2)
8. Derive Cayley–Hamilton equation and the application in Diagonalization. (K4)
9. Derive the equation for Flow of heat in an infinite and in a semi - infinite medium. (K3)
10. Find out the solution for Legendre polynomials. (K5)

Part C

11. Define vector space and explain the meaning of complete orthonormal set of basis vectors.(K1)
12. Derive Cauchy Integral Formula.(K2)
13. Analyze the characteristics of the given matrices and find out Eigen value and Eigen function. (K4)
14. Apply Fourier transform and found out the relation for heat flow in an infinite and a semi - infinite medium.(K3)
15. Solve Hermite differential equation.(K6)

Dr.C.Nirmala Louis
Head of the Department

Dr.M.Abila Jeba Queen & Dr.R.Krishna Priya
Course Instructor

Teaching Plan

Department : Physics
Class : I M.Sc. Physics

Title of the Course: Core Course II: CLASSICAL MECHANICS AND RELATIVITY

Semester : I
Course Code: PP231CC2

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PP231CC2	6	-	-	-	5	6	90	25	75	100

Objectives

1. To understand fundamentals of classical mechanics.

2. To understand Lagrangian and Hamiltonian formulation of mechanics and apply it to solve equation of motion.

Course outcomes

Course Outcomes

Upon completion of this course the students will be able to:		
CO1	Understand the fundamentals of classical mechanics.	**K2**
CO2	Apply the principles of Lagrangian mechanics to solve the equations of motion of physical systems.	**K3**
CO3	Apply the principles of Hamiltonian mechanics to solve the equations of motion of physical systems.	**K3**
CO4	Analyze the small oscillations in systems and determine their normal modes of oscillations.	**K2, K4**
CO5	Understand and apply the principles of relativistic kinematics to the mechanical systems.	**K2, K3**

Teaching plan

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**Principles of Classical Mechanics**					
	1.	Mechanics of a single particle – mechanics of a system of particles	4	K2(U)	Lecture, Group Discussion and Problem Solving	Evaluation through: Online quiz, short questions Descriptive answers MCQ, True/False, Concept explanations, Formative assessment I
	2.	Conservation laws for a system of particles – constraints	3	K2 (U)	Lecture, Group Discussion and Problem Solving	
	3.	Holonomic & non-holonomic constraints	3	K2 (U)	Lecture, Group Discussion and Problem Solving	
	4.	Generalized coordinates – configuration space	3	K2 (U)	Group Discussion and lecture	
	5.	Transformation equations	3	K2 (U)	Lecture using Chalk and talk	
	6.	Principle of virtual work	2	K2 (A)	Lecture using Chalk and talk	
II		**Lagrangian Formulation**				Evaluation through: Online quiz, short questions Descriptive answers MCQ, True/False, Concept explanations, Formative assessment I
	1.	D'Alembert's principle –	5	K2 (U)	Lecture, Group Discussion and Problem Solving	
	2.	Lagrangian equations of motion for conservative systems	6	K3 (Ap)	Lecture, Group Discussion and Problem Solving	
	3.	Applications: (i) simple pendulum (ii) Atwood's Machine (iii) projectile motion	7	K3 (Ap)	Lecture, Group Discussion and Problem Solving	
III	1.	**Hamiltonian Formulation:** Phase space – Cyclic coordinates	2	K2 (U)	Lecture, Group Discussion and Problem Solving	Evaluation through: Online quiz, short questions Descriptive answers
	2.	Conjugate	4	K3 (Ap)	Lecture, Group	

		momentum – Hamiltonian function			Discussion and Problem Solving	MCQ, True/False, Concept explanations, Formative assessment I
	3.	Hamilton's canonical equations of motion – applications	6	K3 (Ap)	Lecture, Group Discussion and Problem Solving	
	4.	Simple pendulum - one dimensional simple harmonic oscillator- motion of particle in a central force field	6	K3 (Ap)	Lecture, Group Discussion and Problem Solving	
IV	1.	**Small Oscillations:** Formulation of the problem–	6	K2 (U)	Lecture, Group Discussion and Problem Solving	Evaluation through: Online quiz, short questions Descriptive answers MCQ, True/False, Concept explanations, Formative assessment II
	2.	Transformation to normal coordinates	6	K4 (A)	Lecture, Group Discussion and Problem Solving	
	3.	Frequencies of normal modes – linear triatomic molecule.	6	K3 (Ap)	Lecture, Group Discussion and Problem Solving	
V	1.	**Relativity**: Inertial and non-inertial frames	3	K2 (U)	Lecture, Group Discussion and Problem Solving	Evaluation through: Online quiz, short questions Descriptive answers MCQ, True/False, Concept explanations, Formative assessment II
	2.	Lorentz transformation equations	4	K4 (A)	Lecture, Group Discussion and Problem Solving	
	3.	Length contraction and time dilation – relativistic addition of velocities –	3	K3 (Ap)	Lecture, Group Discussion and Problem Solving	
	4.	Einstein's mass-energy relation – Minkowski's space	4	K3 (Ap)	Lecture, Group Discussion and Problem Solving	
	5.	four vectors – position, velocity, momentum, acceleration and force in for vector	4	K3 (Ap)	Lecture using Chalk and talk ,Introductory session	

		notation and their transformations.				
				K3 (Ap)		

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 : -

Assignment : **Normal Coordinates- Formulation : Online Assignment**

Seminar Topic: **Frames of Reference**

Sample questions (minimum one question from each unit)

Part A

1. The total linear momentum of the system is equal to the product of total mass of the system and the velocity of _____.**(K2-U, CO1)**
2. An expression for principle of virtual work is _____. **(K3- Ap, CO2)**
3. The equation of motion of a simple pendulum is _____.**(K3 – Ap, CO2)**
4. The Hamiltonian of a one dimensional harmonic oscillator is ----------**(K4- A, CO3)**
5. The frequency associated with the period of motion is ----------**(K2- U, CO5)**

Part B

1. Interpret work- kinetic energy theorem. **(K2- U, CO1)**
2. Solve the equation of motion of a simple pendulum by using Lagrangian method and hence deduce the formula for its time period for small amplitude oscillations.**(K3 – Ap, CO2)**
3. Explain the physical significance of Hamiltonian. **(K4- A, CO3)**
4. Deduce normal coordinates and normal frequencies of vibration. **(K3- Ap, CO2)**
5. Explain Lorentz transformation. **(K2-U, CO-2)**

Part C

1. Classify constraints with suitable examples.**(K2 – U, CO1)**
2. Illustrate the Lagrangian equation of motion using D'Alemberts principle. **(K3 – Ap, CO2)**
3. Formulate the Hamilton's Canonical equation of motion.**(K4- A, CO3)**
4. Discuss the free vibrations of linear triatomic molecule. **(K3 – Ap, CO2)**
5. Explain Minkowski's space. **(K4 – A, CO4)**

Head of the Department

Dr. C. Nirmala Louis

Course Instructor

Dr. M. Priya Dharshini, Dr. A. Lesly Fathima & Dr. P. Aji Udhaya

Teaching Plan

Department : Physics
Class : I M.Sc Physics
Title of the Course : Core-III : Linear and Digital ICs and Applications
Semester : I
Course Code : PP231CC3

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
PP231CC3	6	-	-	4	6	90	25	75	100

Objectives

- To introduce the basic building blocks of linear integrated circuits.
- To introduce the concepts of waveform generation and introduce one special function ICs.

Course outcomes

CO	Upon completion of this course, the students will be able to:	PSO addressed	Cognitive level
CO - 1	Remember the basic concepts for the circuit configuration for the design of linear integrated circuits and develops skill to solve problems	PSO - 1	**K1 & K2**
CO - 2	Develop skills to design linear and non-linear applications circuits using Op-Amp and design the active filters circuits.	PSO - 2	**K2 & K3**
CO - 3	Apply knowledge about PLL, and develop the skills to design the simple circuits using IC 555 timer and can solve problems related to it.	PSO - 3	**K2 & K5**
CO - 4	Analyze about various techniques to develop A/D and D/A converters.	PSO - 3	**K4 & K5**
CO - 5	Evaluate and to create the knowledge about the CMOS logic, combinational and sequential circuits	PSO - 4	**K3 & K6**

Teaching plan

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	1.	Introduction; Classification of IC‘s	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 Short Summary or Overview
	2.	basic information of Op-Amp 741 and its features,	4	K1(R)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	
	3.	the ideal Operational amplifier, Op-Amp internal circuit	6	K2(U)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping,	
	4.	Op-Amp; Characteristics.	4	K2(U)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	
II	5.	Solution to simultaneous equations and differential equations	5	K2(U)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping,	Evaluation through: short test Class Test Multiple choice questions Quiz Formative assessment Short Summary or Overview
	6.	Instrumentation amplifiers, V to I and I to V converters.	5	K2(U)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	
	7.	Sample and Hold circuit, Log and Antilog amplifier, multiplier and divider	5	K3(Ap)	Lecture using Chalk and talk ,Introductory session, Group Discussion,	

					Mind mapping,	
	8	Comparators, Schmitt trigger, Multivibrators, Triangular and Square waveform generators	3	K3(Ap)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	
III	9	Introduction, Butterworth filters – 1st order, 2nd order low pass and high pass filters	5	K2(U)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping,	Evaluation through: short test Class Test Multiple choice questions Quiz Formative assessment Short Summary or Overview
	10	band pass, band reject and all pass filters.	5	K2(U)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	
	11	Introduction to IC 555 timer, description of functional diagram, monostable and astable operations and applications, Schmitt trigger	5	K5(E)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping,	
	12	PLL - introduction, basic principle, phase detector/comparator, voltage controlled oscillator (IC 566), low pass filter, monolithic PLL and applications of PLL	3	K5(E)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	
IV	13	Introduction, Series Op-Amp regulator, IC Voltage Regulators	5	K4(An)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping,	Evaluation through: short test Class Test Multiple choice
	14	IC 723 general	5	K4(An)	Peer tutoring, Lecture using	

		purpose regulators, Switching Regulator.			videos, Problem solving, Demonstration, PPT, Review	questions Quiz Formative assessment Short Summary or Overview
	15	Introduction, basic DAC techniques - weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A to D converters	5	K5(E)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping,	
	16	parallel comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC Specifications.	3	K5(E)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	
V	17	Study of logic gates using 74XX ICs, Four-bit parallel adder (IC 7483), Comparator (IC 7485), Decoder (IC 74138, IC 74154)	5	K3(R)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping,	Evaluation through: short test Class Test Multiple choice questions Quiz Formative assessment Short Summary or Overview
	18	BCD to 7-segment decoder (IC7447), Encoder (IC74147), Multiplexer (IC74151), Demultiplexer (IC 74154)	5	K3(Ap)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	
	19	Sequential circuits using TTL 74XX ICs: Flip Flops (IC 7474, IC 7473), Shift Registers	5	K6(C)	Lecture using Chalk and talk ,Introductory session, Group Discussion, Mind mapping,	
	20	Universal Shift Register (IC 74194), 4- bit asynchronous binary counter (IC 7493).	3	K6(C)	Peer tutoring, Lecture using videos, Problem solving, Demonstration, PPT, Review	

Course Focussing on Employability/ Entrepreneurship/ Skill Development :
Entrepreneurship

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 : Four-bit parallel adder (IC 7483)

Seminar Topic: Multiplier and Divider

Sample questions (minimum one question from each unit)

Part A

1. If the output voltage is feedback to the non-inverting input terminal as part of the input, then the feedback is _____**(K1-R, CO-1)**
2. Which one of the following is an electronic circuit that generates square waves? **(K2-U, CO-2)**

a) Amplifier b) Oscillator c) Multivibrator d) Conductor

3. A ---------- clipper removes the positive half-cycles of the input voltage. **(K2-U, CO-3)**
4. The practical use of binary-weighted digital-to-analog converters is limited to **(K4- An, CO 5)**

a) 4-bit D/A converters b)2-bit D/A converters

c) 8-bit D/A converters d) Op-amp comparators

5. A circuit with many inputs but only one output is _____**(K3-Ap, CO-5)**

a) Multiplexer b) Demultiplexer c) Encoder d)Decoder

Part B

1. Compare inverting and non-inverting operational amplifier.**(K2-U, CO-1)**

2. Determine the output waveform of a bistable multivibrator. **(K2-U, CO-2).**

3. Write on quantization in signal conversion **(K5- E, CO- 3)**

4. Discuss in detail about the Schmitt trigger. **(K4-An, CO-4)**
5. What is a flip-flop. compare the truth table of RS flip-flop implementing using NOR and NAND gates. **(K3-Ap, CO-5)**

Part C

1. Differentiate how the op-amp acts as an integrator and differentiator **(K2-U, CO-1)**

2. Determine the output waveform of a astable multivibrator. **(K3-Ap, CO-2)**

3. Explain the working of active filters as low, high and band pass first and second order filters. **(K5- E, CO- 3)**

4. Explain in detail with circuit diagram, the construction and working of an op-amp as the Triangular wave generator. **(K5- E, CO -4)**

5. Describe the working of AM receiver using a Phase-Locked Loop**.(K6-C,CO-5)**

Dr. C. Nirmala Louis
Head of the Department

Dr. S. Sonia & Dr. S. Virgin Jeba
Course Instructor

Teaching Plan

Department : Physics
Class : I M.Sc. Physics
Title of the Course : Elective : Energy Physics
Semester : I
Course Code : PP231EC1

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
PP231DE1	5	-	-	3	5	75	25	75	100

Objectives

- To learn about various renewable energy sources, the techniques useful for the conversion of biomass into useful energy
- To know the ways of effectively utilizing the oceanic energy, utilization of solar energy.
- To study the method of harnessing wind energy and its advantages.

Course outcomes

COs	Upon completion of this course, students will be able to:	PSO addressed	CL
CO 1	To identify various forms of renewable and non-renewable energy sources	PSO-1	U
CO 2	Understand the principle of utilizing the oceanic energy and apply it for practical applications.	PSO-2	U
CO 3	Discuss the working of a windmill and analyze the advantages of wind energy.	PSO-3	E
CO 4	Distinguish aerobic digestion process from anaerobic digestion.	PSO-6	C
CO 5	Understand the components of solar radiation, their measurement and apply them to utilize solar energy.	PSO-1	U

Teaching plan

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	**INTRODUCTION TO ENERGY SOURCES**					
	1	Conventional and non-conventional energy sources and their availability	**4**	K1(R)	PPT, Illustration	Evaluation through: Online quiz, Problem solving short questions Descriptive answers MCQ, True/False, Short essays, Concept explanations, Short summary or overview Formative assessment I
	2	Prospects of Renewable energy sources– Energy from other sources	**4**	K3(Ap)	Group discussion	
	3	Chemical energy– Nuclear energy	**3**	K5(E)	PPT, Illustration,	
	4	Energy storage and Distribution	**4**	K6(C)	Group discussion	
II	**ENERGY FROM THE OCEANS**					
	1	Energy utilization– Energy from tides	**4**	K2(U)	PPT, Derivation discussion	Evaluation through: Online quiz, Problem solving short questions Descriptive answers Formative assessment I
	2	Basic principle of tidal power	**4**	K3(A)	Group discussion, PPT	
	3	Utilization of tidal energy	**3**	K4(An)	Illustration,	
	4	Principle of ocean thermal energy conversion systems.	**4**	K5(E)	Group discussion, PPT, Illustration	
III	**WIND ENERGY SOURCES**					
	1	Basic principles of wind energy conversion	**4**	K2(U)	Discussion	Evaluation through: Online quiz, Problem

	2	Power in the wind– forces in the Blades	**4**	K3(Ap)	Illustration, PPT	solving short questions Descriptive answers MCQ, True/False, Short essays, Concept explanations, Short summary or overview Formative assessment I/II
	3	Wind energy conversion– Advantages and disadvantages of wind energy	**3**	K6(C)	Group discussion, PPT	
	4	Conversion systems (WECS) - Energy storage–Applications of wind energy.	**4**	K4(An)	PPT, Illustration	
IV	**ENERGY FROM BIOMASS**					
	1	Biomass conversion Technologies– wet and dry process–	**4**	K1(R)	Discussion	Evaluation through: Online quiz, Problem solving short questions Descriptive answers MCQ, True/False, Short essays, Concept explanations, Short summary or overview Formative assessment II
	2	Photosynthesis - Biogas Generation: Introduction–basic process:	**4**	K3(Ap)	Group discussion, PPT	
	3	Aerobic and anaerobic digestion – Advantages of anaerobic digestion–	**3**	K5(E)	Group Discussion	
	4	Factors affecting bio digestion and generation of gas-bio gas from waste fuel– properties of biogas-utilization of biogas.	**4**	K6(C)	Group Discussion	
V	**SOLAR ENERGY SOURCES**					
	1	Solar radiation and its measurements	**4**	K2(U)	PPT	Evaluation through: Online quiz, Problem solving short questions Descriptive answers MCQ,
	2	solar cells: Solar cells for direct conversion of solar energy to electric powers	**4**	K1(R)	Group discussion, PPT	

	3	solar cell parameter– solar cell electrical characteristics– Efficiency–solar water Heater	**3**	K3(Ap)	Group Discussion	True/False, Short essays, Concept explanations, Short summary or overview Formative assessment II
	4	Solar distillation– solar cooking–solar greenhouse – Solar pond and its applications	**4**	K5(E)	Group discussion, PPT	

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

Activities (Em/ En/SD): **Project, Exhibition, Field visit**

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

Activities related to Cross Cutting Issues: - **Industrial Visit**

Assignment: (Mention Topic and Type): **Current global issues – Submission through Google Classroom**

Seminar Topic: (if applicable): **Sustainable Energy for Future**

Sample questions (minimum one question from each unit)

Part A (1 mark)

1. What is the correct sequence of energy change from one form to another in a thermal power station when coal is used for generating electricity? **(K2- U, CO 1)**
   a) Heat energy > Chemical energy >Electrical energy
   b) Mechanical energy >Electrical energy > Heat energy
   c) Heat energy >Mechanical energy >Electrical energy
   d) Chemical energy >Heat energy >Mechanical energy
2. Energy Conservation Day is celebrated on _____(**K4- An, CO 5)**
   a)January 14th b)March 14th c)August 14th d)December 14th
3. Choose the right answer: Wind is the form of _____ energy. **(K5- E, CO3)**
   a)Renewable energy b) Non-renewable energy

4. To convert sound energy into electrical energy, which device is used? **(K6- C, CO 4)**
   a)Micro oven b)Refrigerator c) Microphones d) Compact Fluorescent Lamps (CFLs)

5. The SI unit of energy is _____**(K2- U, CO 1)**

a) Volts b) Watts c) Joule d) Radians

Part B

6. Explain the chemical energy. **(K5- E, CO 3)**
7. Discuss the basic principle of tidal power **(K2- U, CO 1)**
8. List the advantages and disadvantages of wind energy conversion systems **(K2- U, CO 1)**
9. Distinguish aerobic and anaerobic digestion. **(K6- C, CO 4)**
10. Write a note on characteristics of solar cell **(K4- An, CO 5)**

Part C

11. Describe the prospects of Renewable energy sources. **(K6- C, CO 4)**
12. Explain the principle of ocean thermal energy and its conversion systems. **(K5- E, CO 3)**
13. Explain the basic principles and working of wind energy conversion **(K6- C, CO 4)**
14. Discuss the factors affecting the biodigestion and generation of gas **(K4- An, CO 5)**
15. Describe the working of solar water Heater **(K5- E, CO 3)**

Ms .V. Shally & Sr. Sebastiammal

Head of the Department Course Instructor

Teaching Plan

Department : Physics
Class : II M.Sc Physics
Title of the Course : CORE COURSE VI: CONDENSED MATTER PHYSICS
Semester : III
Course Code : PP233CC1

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
PP233CC1	6	-	-	5	6	90	25	75	100

Learning Objectives:

1. To gain a comprehensive understanding of the fundamental principles in condensed matter physics, including crystallography, lattice dynamics, the theory of metals, semiconductors, magnetism and superconductivity.
2. To apply advanced concepts and theories learned in condensed matter physics to analyze and interpret experimental observations and phenomena in material science.

Course Outcomes

On the successful completion of the course, students will be able to:		
1.	identify various crystal structures, symmetry and differentiate different types of bonding.	**K1**
2.	understand the lattice dynamics and apply it to concept of specific heat.	**K2**
3.	articulate different types of magnetic materials and explain the underlying phenomena.	**K3**
4.	relate the concepts of superconductivity, the underlying theories – related to current areas of research.	**K4**
5.	assess various theories of electrons in solids and their impact in distinguishing solids.	**K5**

Teaching plan

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/Evaluation
I	**CRYSTAL PHYSICS**					
	1	Types of lattices - Miller indices - Symmetry elements and allowed rotations - Simple crystal structures - Atomic Packing Factor- Crystal diffraction	**4**	K1(R)	PPT, Illustration and theoretical derivation,	Evaluation through: Online quiz, Problem solving short questions Descriptive answers MCQ, True/False, Short essays, Concept explanations, Short summary or overview Formative assessment I
	2	- Bragg's law - Scattered Wave Amplitude - Reciprocal Lattice (sc, bcc, fcc) - Structure and properties of liquid crystals	**5**	K3(Ap)	Derivation and group discussion,	
	3	Diffraction Conditions - Laue equations - Brillouin zone - Structure factor - Atomic form factor - Inert gas crystals	**5**	K5(E)	PPT, Illustration, Theoretical formulation	
	4	Cohesive energy of ionic crystals - Madelung constant - Types of crystal binding (general ideas).	**4**	K4(An)	Derivation and group discussion	
II	**LATTICE DYNAMICS**					

	1	Lattice with two atoms per primitive cell - First Brillouin zone - Group velocity - Long Wavelength Limit	**5**	K2(U)	Lecture discussion with illustration, Derivation and group discussion	Evaluation through: Online quiz, Problem solving short questions Descriptive answers Formative assessment I
	2	Derivation of Force Constants from Experiment - Quantization of lattice vibrations - Phonon momentum - Inelastic scattering by phonons	**4**	K3(A)	Derivation and group discussion problem solving Lecture Discussion with PPT illustration	
	3	Phonon Heat capacity- Planck Distribution- Normal Mode Enumeration- Density of States in Three Dimensions	**5**	K4(An)	Illustration, Theoretical formulation Lecture Discussion with PPT illustration	
	4	Debye's theory of lattice heat capacity - Thermal Conductivity - Umkalapp processes.	**4**	K5(E)	Derivation and group discussion problem solving	
III	**THEORY OF METALS AND SEMICONDUCTORS**					
	1	Free electron gas in three dimensions - Electronic heat capacity - Wiedemann-Franz law - Band theory of metals and semiconductors	**5**	K2(U)	Lecture discussion with illustration, Derivation and group discussion	Evaluation through: Online quiz, Problem solving short questions Descriptive answers MCQ, True/False, Short essays, Concept explanations, Short summary or overview
	2	Bloch theorem - Kronig-Penney model -	**5**	K3(Ap)	Illustration, Theoretical formulation	

		Semiconductors - Intrinsic carrier concentration - Temperature Dependence			Discussion with PPT illustration	Formative assessment I/II
	3	Mobility - Impurity conductivity - Impurity states - Hall effect	**4**	K5(E)	Derivation and group discussion, PPT designing	
	4	Fermi surfaces and construction - Experimental methods in Fermi surface studies - de Hass-van Alphen effect.	**4**	K4(An)	PPT, Illustration, Theoretical formulation	
IV	**MAGNETISM**					
	1	Diamagnetism - Quantum theory of paramagnetism - Rare earth ion - Hund's rule - Quenching of orbital angular momentum	**4**	K1(R)	Lecture discussion with illustration, Derivation and group discussion	Evaluation through: Online quiz, Problem solving short questions Descriptive answers MCQ, True/False, Short essays, Concept explanations, Short summary or overview Formative assessment II
	2	Adiabatic demagnetization - Quantum theory of ferromagnetism - Curie point - Exchange integral	**5**	K3(Ap)	Derivation and group discussion, PPT	
	3	Heisenberg's interpretation of Weiss field - Ferromagnetic domains - Bloch wall - Spin waves - Quantization	**5**	K5(E)	Lecture discussion with illustration, Derivation and group discussion	
	4	Magnons - Thermal excitation of magnons - Curie temperature and	**4**	K4(An)	Derivation and group discussion	

		susceptibility of ferrimagnets - Theory of antiferomagnetism.				
V	**SUPERCONDUCTIVITY**					
	1	Meissner effect - Critical field – Critical current - Entropy and heat capacity - Energy gap - Type I and II Superconductors	**4**	K2(U)	Lecture discussion with illustration, Derivation and group discussion	Evaluation through: Online quiz, Problem solving short questions Descriptive answers MCQ, True/False, Short essays, Concept explanations, Short summary or overview Formative assessment II
	2	Thermodynamics of super conducting transition - London equation - Coherence length – Isotope effect - Cooper pairs	**5**	K1(R)	Derivation and group discussion, PPT designing	
	3	Bardeen Cooper Schrieffer (BCS) Theory - Single particle tunneling - Josephson tunnelling	**5**	K3(Ap)	Lecture discussion with illustration, Derivation and group discussion	
	4	DC and AC Josephson effects - High temperature Superconductors – SQUIDS	**4**	K5(E)	Derivation and group discussion, PPT	

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

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

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): **Debye's theory of lattice heat capacity - descriptions through Google Classroom**

Seminar Topic: (if applicable): **Exercise Problem solving and derivation of physical parameters**

Sample questions (minimum one question from each unit)

Part A (1 mark)

1. There are _____ types of Bravais lattice. **(K4- An, CO 5)**

a) 9 b) 12 c) 14 d) 10

2. The expression for Bragg's Law is nλ= _____. **(K2- U, CO 1)**

a) d sinθ b) d cosθ c) 2d sinθ d) 2d cosθ

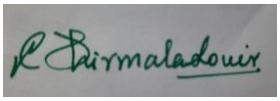
3. The transmission velocity of a wave packet is _____. **(K4- An, CO3)**
4. Ferromagnetic materials exhibits magnetization even after the applied field is removed. Say True or False. **(K4- An, CO3)**
5. The superconducting transition temperature was experimentally found to vary with the isotope mass. Say true or false. **(K2- U, CO 1)**

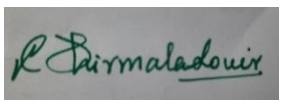
Part B (6 marks)

6. Infer about Bravais lattice in three dimensions **(K5- E, CO 3)**
7. Analyze the quantization of elastic waves **(K4- An, CO 5)**
8. What do you understand by intrinsic and extrinsic semiconductors? **(K2- U, CO 1)**
9. Criticize the Antiferromagnetism. **(K6- C, CO 4)**
10. Describe Type–I and Type–II Superconductors. **(K4- An, CO 5)**

Part C (12 marks)

11. Estimate the expression for cohesive energy in ionic crystals. **(K5- E, CO 3)**
12. Explain Phonon Heat capacity and Planck Distribution **(K2- U, CO 1)**
13. Define Bloch theorem and derive Kronig-Penney model **(K4- An, CO 5)**
14. Discuss the Weiss Molecular (exchange) Field **(K5- E, CO2)**
15. Construct DC Josephson effect in superconductors Tunneling. **(K2- U, CO 1)**





Dr.C.Nirmala Louis & Dr. S. Sebastiammal

Head of the Department Course Instructors

Teaching Plan

Department : Physics
Class : II M.Sc. Physics
Title of the Course : Core CourseVII: Electromagnetic Theory
Semester : III
Course Code : PP233CC2

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PP233CC2	6	–	–	–	5	6	90	25	75	100

Learning Objectives:

1. To acquire knowledge about boundary conditions between two media and the technique of method of separation of variables
2. To assimilate the concepts of propagation, polarization, reflection and refraction of electromagnetic waves

Course Outcomes

COs	Upon completion of this course, students will be able to:	PSO addressed	CL
CO-1	understand the basic laws of electromagnetism.	PSO - 1	K1(R)
CO-2	recognize the behaviour of electric and magnetic fields in simple configurations under different boundary conditions.	PSO - 1	K2(U)
CO-3	apply the concepts of electrodynamics and derive the Maxwell's equation.	PSO - 3	K3(Ap)
CO-4	analyse the concept of propagation in linear media.	PSO - 4	K4(An)
CO-5	prioritize the magnetic properties of matter.	PSO - 2	K5(E)

Teaching plan

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/ Evaluation
I	ELECTROSTATICS					
	1	Coulomb's law- Electric field – field lines, flux and Gauss's Law in differential	4	K1(R)	Lecture, Illustration and PPT	Evaluation through: quiz nearpod

		form – application of Gauss's law			using gamma	
	2	curl of E - Poisson's equation- Laplace's equation -one and two dimensions	4	K2(U)	Illustration, PPT	Formative assessment
	3	boundary conditions and uniqueness theorem - solution in cartesian and spherical polar coordinates	4	K2(U)	Lecture Discussion using gamma	Evaluation through: quiz using Kahoot
	4	electric displacement - gauss's law in the presence of dielectrics	3	K3(Ap)	Illustration and AI tool	Solving simple problems
	5	linear dielectrics - electrostatic energy in the presence of dielectric.	3	K2(U)	Lecture Discussion using gamma	Evaluation through short test
II	**MAGNETOSTATICS**					
	1	Lorentz force Law -Biot-Savart's Law –Steady currents – The magnetic field of a steady current	4	K2(U)	Lecture, Illustration	Evaluation through: quiz using Kahoot
	2	divergence and curl of B - Magnetic vector- potential – The vector potential – Magnetostatic boundary conditions –	4	K2(U)	Lecture Discussion using PPT	Class test Solutions to problems
	3	Multipole expansion of the vector potential- Magnetization - torques and forces on magnetic dipoles	5	K3(Ap)	Lecture ,Illustration using AI tool	Evaluation through short test using nearpod
	4	Effect of a magnetic field on atomic orbits–Ampere's law in magnetized materials - Uniformly magnetized sphere.	5	K3(Ap)	Lecture Discussion using gamma	Evaluation through short test using nearpod
III	**MAXWELL EQUATIONS**					
	1	Faraday's laws of Induction - Maxwell's displacement current - Maxwell's equations - Energy and momentum of the field	4	K2(U)	Introductory session, Lecture using Chalk and talk , PPT	Evaluation through short test, MCQ, True/False, Short essays
	2	Poynting's theorem - Maxwell's stress tensor -	4	K3(Ap)	Lecture using Chalk and	Concept definitions,

		Conservation of momentum			talk , Problem Solving, PPT	MCQ
	3	Electromagnetic waves - Waves in one dimension – wave equation – sinusoidal waves	4	K3(Ap)	Lecture using Chalk and talk , Problem Solving, PPT	Evaluation through short test, Long derivation
	4	reflection and transmission – Polarization - scalar and vector potentials	4	K3(Ap)	Lecture using Chalk and talk , Problem Solving, PPT	Evaluation through short test, Long derivation
	5	Gauge Transformation - Coulomb and Lorentz gauge.	2	K2(U)	Lecture using Chalk and talk , Problem Solving, PPT	Evaluation through short test, MCQ, True/False, Short essays
IV	**WAVE PROPAGATION**					
	1	Electromagnetic waves in vacuum – The wave equation for E and B – Monochromatic plane waves	5	K2(U)	Introductory session, Lecture using Chalk and talk , PPT	Evaluation through short test, MCQ, True/False, Short essays
	2	energy and momentum in electromagnetic waves - Electromagnetic waves in matter	4	K4(An)	Lecture using videos, Problem solving, Demonstration	Concept definitions, MCQ
	3	Propagation in Linear Media – Reflection and transmission at normal incidence	4	K4(An)	Lecture using videos, Problem solving, Demonstratio	Evaluation through short test, MCQ, True/False

					n	
	4	Reflection and transmission at oblique incidence - Propagation of waves in a rectangular wave guide - the co– axial transmission line.	5	K4(An)	Lecture using videos, Problem solving, Demonstration	Evaluation through Definition, Derivation Test
V	**RELATIVISTIC ELECTRODYNAMICS**					
	1	Special theory of relativity-Einstein's Postulates-geometry of relativity – relativity of simultaneity	5	K2(U)	Lecture Illustration	Evaluation through: quiz, Formative Assessment
	2	time dilation –Lorentz contraction-relativistic mechanics-proper Time and velocity	4	K4(U)	Illustration	Evaluation through short test
	3	relativistic energy-momentum-kinematics-dynamics- relativistic electrodynamics	4	K3(Ap)	Lecture Discussion using gamma	Class test Solutions to problems
	4	magnetism as a relativistic phenomenon-field transformation Electrodynamics in tensor potentials -relativistic potentials –d'Alembertian	5	K5(E)	Lecture ,Illustration using slido	Class test Solutions to problems

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

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

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

Assignment: Relativity of simultaneity

Seminar Topic: Gauss law in the presence of dielectrics, Ampere's law in magnetize materials, Coulomb and Lorentz gauge, energy and momentum in electromagnetic waves, relativistic potentials

Sample questions (minimum one question from each unit)

Part A

1. Choose the expression for Laplace equation.**(K1-R, CO-1)**

a) $\nabla^2 V=0$ b) $\nabla^2 V=\alpha E$ c) $\nabla^2 V=\rho/\varepsilon_0$ d) $\nabla V=0$.

2. State True/False. In electrostatics, steady currents produce magnetic fields that are constant in time. **(K2-U, CO-2)**
3. One of the following are the waves that are travelling in the z direction and have no x or y dependence. **(K1-R, CO-1**)

   a) EM waves b) plane waves c) polarized waves d) unpolarized waves
4. Which of the following is the expression for Snell's law?**(K4-An,CO-4)**

   a) $\frac{Sin\theta_T}{Sin\theta_I} = \frac{n_1}{n_2}$ b) $\frac{Sin\theta_T}{Sin\theta_I} = \frac{n_2}{n_1}$ c) $\frac{Cos\theta_T}{Sin\theta_I} = \frac{n_1}{n_2}$ d) $\frac{Sin\theta_T}{cos\theta_I} = \frac{n_1}{n_2}$
5. What is referred as the angle at which the reflected wave completely extinguished? (**K5-E, CO4)**

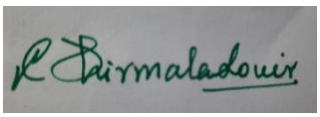
   a) Incident angle b) critical angle c) Brewster's angle d) transmitted angle

Part B

1. Show that curl of E is zero.**(K1-R, CO-1)**
2. Illustrate that magnetic forces do no work.**(K3-Ap,CO-3)**
3. Elucidate the wave equation for E and B.**(K2-U, CO-1)**
4. Outline energy and momentum in electromagnetic waves.**(K4-An, CO-4)**
5. Evaluate time dilation.**(K5-E, CO-5)**

Part C

1. Explain the Laplace equation in one dimension and two dimensions. (**K1-R, CO-1)**
2. Derive an expression for the effect of magnetic field on atomic orbits. **(K2-U, CO-2)**
3. State and prove Poynting's theorem.**(K3-Ap, CO-3)**
4. Outline the reflection and refraction of E.M. waves at normal incidence.**(K4-An, CO-4)**
5. Describe the relativity of simultaneity. **(K2-U, CO-1)**



Head of the Department

Dr. M.Priya Dharshini & Dr.S.Virgin Jeba
Course Instructor

Teaching Plan

Department : Physics
Class : II M.Sc Physics
Title of the Course : ELECTIVE COURSE IV: b):MICROPROCESSOR AND MICROCONTROLLER
Semester : III
Course Code : PP233EC2

Course Code	L	T	P	S	Credits	Inst. Hours	Total Hours	Marks		
								CIA	External	Total
PP233EC2	4	-	-	-	3	4	60	25	75	100

Learning Objectives:

1. To offer insight into the architecture and operation of microprocessor 8085A and to the techniques for interfacing I/O devices and memory with the microprocessor.
2. To introduce programming and applications for the 8085A, along with exploring the architecture and instruction sets of the 8051 microcontroller.

Course Outcomes

On the successful completion of the course, students will be able to:		
1	illustrate the architecture and functionality of the 8085 microprocessor.	**K1**
2	infer the architecture and functionality of the 8051 Microcontroller.	**K2**
3	apply the addressing modes and data transfer scheme for 8085 microprocessor and 8051 microcontroller.	**K3**
4	categorise instructions to develop programs for measuring various electrical and physical quantities.	**K4**
5	evaluate the interfacing of microprocessors and microcontrollers and develop external devices across various applications.	**K5& K6**

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

Teaching plan

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

Unit	Module	Topic	Teaching Hours	Cognitive Level	Pedagogy	Assessment/ Evaluation
I	**8085 ARCHITECTURE, PROGRAMMING AND PERIPHERALS**					
	1	Intel 8085 microprocessor - Pin configuration-Architecture	3	K1 (R)	Lecture –cum-Group Discussion	Evaluation

	2	Instruction set- Data transfer operations-Arithmetic operations - Logical operations - Branching and machine control operations	3	K1 (R)	Lecture, Group Discussion and Problem Solving	through: Online quiz, short questions Descriptive answers MCQ, True/False, Concept explanations, Formative assessment I
	3	Memory and I/O interfacing- Data transfer schemes -	3	K1 (R)	Lecture, Group Discussion and Problem Solving	
	4	Programmable peripheral interface –- Control group and control word– Programmable DMA controller.	3	K1 (R)	Group Discussion and Problem solving	
II	**8085 INTERFACING APPLICATIONS**					
	1	8085 interrupts – Seven segment display interface - Stepper motor interface	3	K5 (Ev)	Lecture –cum- Group Discussion and Practical Demonstration	Evaluation through: Online quiz, short questions Descriptive answers MCQ, True/False, Concept explanations, Formative assessment II
	2	Interfacing of Digital to Analog converter and Analog to Digital converter	3	K5 (Ev)	Lecture, Group Discussion and Problem Solving	
	3	Measurement of electrical quantities – Voltage and current Measurement	3	K5 (Ev)	Lecture, Group Discussion and Problem Solving	
	4	Measurement of physical quantities –Temperature measurement and control – strain measurement.	3	K5 (Ev)	Group Discussion and Problem solving	
III	**8051 MICROCONTROLLER HARDWARE**					
	1	Introduction – Features of 8051– Input/ Output pins, Ports and Circuits	3	K2 (U)	Lecture –cum- Group Discussion and Practical Demonstration	Evaluation through: Online quiz, short questions Descriptive answers MCQ, True/False, Concept explanations, Formative assessment I
	2	8051 Microcontroller Hardware: Pin-out 8051, Central Processing Unit	3	K2 (U)	Lecture, Group Discussion and Problem Solving	
	3	internal RAM, Internal ROM, Register set of 8051 – Memory organization of 8051	3	K2 (U)	Lecture, Group Discussion and Problem Solving	
	4	External data memory and program memory: External program memory, External data memory.	3	K2 (U)	Group Discussion and Problem solving	
IV	**8051 ASSEMBLY LANGUAGE PROGRAMMING**					
	1	Addressing modes – Data transfer instructions: Instructions to Access external data memory, external ROM /	4	K4 (An)	Lecture –cum- Group Discussion	Evaluation through: Online quiz,

		program memory				short questions Descriptive answers MCQ, True/False, Concept explanations, Formative assessment II
	2	PUSH and POP instructions, Data exchange instructions	2	K4 (An)	Lecture, Group Discussion and Problem Solving	
	3	Logical instructions – Arithmetic instructions	2	K4 (An)	Lecture, Group Discussion and Problem Solving	
	4	Decimal arithmetic - Jump and CALL instructions: Jump, Call and subroutines.	4	K4 (An)	Lecture, Group Discussion and Problem Solving	
V	**INTERRUPT AND INTERFACING TO EXTERNAL WORLD**					
	1	8051 Interrupts –Enabling and disabling an interrupt	3	K2 (U)	Lecture –cum-Group Discussion	Evaluation through: Online quiz, short questions Descriptive answers MCQ, True/False, Concept explanations, Formative assessment-II
	2	Interrupt priority: Nested interrupts –Software triggering – LED Seven segment display interface	3	K2 (U)	Lecture, Group Discussion and Problem Solving	
	3	Interfacing of D/A converter and A/D converter - Stepper motor interface.	3	K5 (E)	Lecture, Group Discussion and Problem Solving	
	4	Measurement of electrical quantities –Voltage and current– Measurement of physical quantities – Temperature and strain.	3	K5 (E)	Group Discussion and Problem solving	

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

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: -

Assignment: (Mention Topic and Type):

Memory and I/O Interfacing-Problem Solving

Seminar Topic: (if applicable): **8051 Interrupts, Enabling and disabling an interrupt**

Sample questions (minimum one question from each unit)

Part A

1. What is the function of stack pointer in 8085 microprocessor? (K1-R, CO-1)
2. State True / False. The seven segment displays are connected directly to I/O ports.(K1-R, CO-1)
3. The 8051 series of microcontrollers are _____ generation 8 bit microcontrollers.(K2-U, CO-2)
4. Name any two 16-bit registers in 8051 microcontroller?(K4-An, CO-4)
5. In interrupt vector table location _____ belongs to timer 1.

Part B

1. Draw the timing diagram for memory read operation.(K1-R, CO-1)
2. Explain the process of measuring strain. (K1-R, CO-1)
3. Write a short note on Internal RAM and ROM of 8051 microcontroller. (K2-U, CO-2)
4. Discuss in detail about the PUSH and POP instructions of microcontroller 8051.(K4-An, CO-4)
5. Describe 8051 interrupts. (K2-U, CO-2)

Part C

1. Explain with schematic diagram, the architecture of 8085 microprocessor(K1-R, CO-1)
2. Write a program to display decimal numbers 0 to 9 in seven segment display. (K5-Ev, CO-5)
3. Explain with schematic diagram, the pin configuration of 8051 microcontroller.
4. Enumerate the different addressing modes of 8051 and explain them in detail with one example for each. (K4-An, CO-4)
5. Explain the interfacing of stepper motor with 8051 microcontroller. (K5-Ev, CO-5)

Head of the Department **Course Instructor**

Dr. C. Nirmala Louis **Dr. R. Krishna Priya & Dr. P. Aji Udhaya**

Teaching Plan

Department : Physics
Class : II M.Sc Physics
Title of the Course : Sewage and Waste Water Treatment and Reuse
Semester : III
Course Code : PP233SE1

No. of hours per week	No. of Credits	Total No. of hours	Marks
3	2	45	100

Objectives

1. To gain basic knowledge in sewage and waste water Treatment procedures
2. To gain industry exposure and be equipped to take up job.

Course Outcomes

COs	Upon completion of this course, students will be able to:	PSO addressed	CL
CO-1	identify solid waste management methods	PSO - 4	U
CO-2	interpret factors affecting disinfection	PSO - 4	An
CO-3	use advanced waste water treatment for removal of suspended solids in the nearby areas	PSO - 4	An
CO-4	connect to related job by gaining industry exposure	PSO - 4	Ap
CO-5	defend solid waste in and around the locality and develop entrepreneurial skills.	PSO- 4	C, E

Modules

Credit: 2 **Total Hours:45**

Unit	Section	Topics	Lecture hours	Cognitive level	Pedagogy	Assesment/ Evaluation
I		**RECOVERY & REUSE OF WATER**				
	1	Methods of recovery: Flocculation – Sedimentation- sedimentation with coagulation	3	K2(U)	Illustration and PPT using gamma	Evaluation through: quiz nearpod Formative assessment Evaluation through short test using nearpod
	2	Filtration - sand filters - pressure filters - horizontal filters	2	K2(U)	Illustration, PPT	
	3	vector control measures in industries	2	K2(U)	Lecture Discussion using	

					gamma	
	4	chemical and biological methods of vector eradication	2	K2(U)	Illustration and AI tool	
II		**DISINFECTION**				
	1	Introduction to disinfection and sterilization: Disinfectant	2	K3(Ap)	Illustration using OLAB	Evaluation through: quiz using hotpotatoes Class test
	2	UV radiation - Chlorination	2	K2(U)	Lecture Discussion using PPT	
	3	Antisepsis - Sterilant - Aseptic and sterile - Bacteriostatic and Bactericidal	3	K3(Ap)	Lecture , llustration using AI tool	
	4	Factors affecting disinfection.	2	K3(Ap)	Lecture Discussion using gamma	
III		**CHEMICAL DISINFECTION**				
	1	Introduction - Theory of Chemical Disinfection - Chlorination Other Chemical Methods	3	K2(U)	Lecture and Discussion using slido	Evaluation through: quiz using quizzes Formative assessment Evaluation through short test Lecture Illustration.
	2	Chemical Disinfection Treatments Requiring - Electricity	2	K2(U)	Illustration	
	3	Coagulation/Flocculation Agents as Pretreatment	2	K3(Ap)	Lecture Discussion using gamma	
	4	Disinfection By-Products (DBPs)	2	K4(An)	Lecture ,Illustration using AI tool	
IV		**PHYSICAL DISINFECTION**				

	1	Introduction - Ultraviolet Radiation-Solar disinfection	2	K1(R)	Lecture Illustration ,	Evaluation through: quiz, using quizzes,slido
	2	Heat Treatment - Filtration Methods - Distillation	3	K3(Ap)	Illustration	
	3	Electrochemical Oxidation	2	K2(U)	Lecture Discussion using gamma	
	4	Water Disinfection by Microwave Heating.	2	K2(U)	Lecture ,Illustration using AI tool	Formative assessment
V		**ADVANCED WASTE WATER TREATMENT**				
	1	Removal of suspended solids, Removal of dissolved solids	2	K2(U)	Lecture Illustration ,	Evaluation through: quiz, Formative Assessment
	2	Nitrogen removal – Phosphorous removal	3	K4(An)	Illustration	
	3	Advanced biological systems	2	K5(E)	Lecture Discussion using gamma	
	4	Chemical oxidation.	2	K6(C)	Lecture ,Illustration using slido	

Course Focussing on Employability/ Entrepreneurship/ Skill Development: **Skill**
Activities (Em / En /SD): **SD**
Course Focusing on Cross Cutting Issues (Professional Ethics/ Human Values/Environment Sustainability/ Gender Equity): - Environment Sustainability activities related to Cross Cutting Issues:- **Environment Sustainability**
Assignment: (Mention Topic and Type): Solve problems, Analyse the Chemical Disinfection
Seminar Topic: (if applicable):-Hazards faced

Sample questions (minimum one question from each unit)

Part A

1. **Which of the following chemicals is commonly used as a flocculant?(K2-U, CO-1)**
   a. Chlorine
   b. Alum (Aluminum sulfate)
   c. Sodium hydroxide
   d. Calcium carbonate

2. **Which of the following forms of chlorine is most commonly used in water treatment?(K2-U, CO-1)**
   a. Chlorine gas (Cl2)
   b. Sodium hypochlorite (NaOCl)
   c. Calcium hypochlorite (Ca(OCl)2)
   d. All of the above
3. State whether the following statement is True or False**(K1-R, CO-1)**
   The effectiveness of sedimentation is independent of the flow rate of water through the tank.
4. In the electromagnetic spectrum ----- spectrum of sunlight is primarily responsible for the disinfection process **(K2-U, CO-2)**
5. Nitrosomonas bacteria are responsible for the conversion of _____ to nitrite in the nitrification process.**(K3-Ap, CO3)**

Part B

1. Explain the theory on coagulation and flocculation. **(K2-U, CO-2)**
2. Analyse the advantages and disadvantages of using autoclaves for sterilization.**(K4-AnU, CO-4)**
3. Analyse the potential ecological impacts of introducing biological control agents into an ecosystem**(K4-An,CO3)**
4. Explain the regulatory standards for sterility in the pharmaceutical and medical device industries**(K2-U, CO-2)**
5. Design an experiment to investigate the impact of varying chlorine doses on the formation of different DBPs.**(K6-C,CO-5)**

Part C

1. The Maximum daily demand at a water purification plant has been estimated as 12 million litres per day. Design the dimensions of a suitable sedimentation tank (fitted with mechanical sludge removal arrangements) for the raw supplies, assuming a detention period of 6 hours and the velocity of flow as 20 cm per minute. (**K6-C, CO-5)**
2. How do coagulation and flocculation work together to remove suspended solids from water(**K2-U, CO-2)**
3. Explain the oxidation state of an element change during a chemical oxidation reaction(**K2-U, CO-2)**
4. Analyse the effect of temperature and pH on the efficiency of chemical oxidation reactions**(K4-An,CO3)**
5. How can nitrogen removal processes be optimized for small-scale or decentralized wastewater treatment systems(**K5-E,CO4)**

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Head of the Department

Course Instructors