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	6	-	-	-	4	6	90	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: 60 (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	4	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	4	K3(Ap)	Lecture using Chalk and talk, PPT.	Evaluation through short test, MCQ, True/False, Explain Principle.
	4.	Eigen values and Eigen functions –	2	K5(E)	Problem solving.	Evaluation through Problem solving
	5.	Direct sum and invariant subspace – orthogonal transformations and rotation.	4	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 .	4	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	4	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.	4	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 .	4	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.	4	K5(E)	Problem solving,	Evaluation through Problem Solving .
	5.	Cayley–Hamilton theorem – Diagonalization.	4	K5(E)	Group Problem Solving	Evaluation through Problem Solving
IV	Fourier Transforms and Laplace Transforms					
	1.	Definitions -Fourier transform and its inverse.	2	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.	3	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 .	3	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	3	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.	4	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	5	-	-	-	4	5	75	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: 60 (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	3	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	2	K2 (U)	Lecture, Group Discussion and Problem Solving	
	3.	Holonomic & non-holonomic constraints	2	K2 (U)	Lecture, Group Discussion and Problem Solving	
	4.	Generalized coordinates – configuration space	2	K2 (U)	Group Discussion and lecture	
	5.	Transformation equations	2	K2 (U)	Lecture using Chalk and talk	
	6.	Principle of virtual work	1	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 –	3	K2 (U)	Lecture, Group Discussion and Problem Solving	
	2.	Lagrangian equations of motion for conservative systems	4	K3 (Ap)	Lecture, Group Discussion and Problem Solving	
	3.	Applications: (i) simple pendulum (ii) Atwood's Machine (iii) projectile motion	5	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	2	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	4	K3 (Ap)	Lecture, Group Discussion and Problem Solving	
	4.	Simple pendulum - one dimensional simple harmonic oscillator- motion of particle in a central force field	4	K3 (Ap)	Lecture, Group Discussion and Problem Solving	
IV	1.	**Small Oscillations:** Formulation of the problem–	4	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	4	K4 (A)	Lecture, Group Discussion and Problem Solving	
	3.	Frequencies of normal modes – linear triatomic molecule.	4	K3 (Ap)	Lecture, Group Discussion and Problem Solving	
V	1.	**Relativity**: Inertial and non-inertial frames	2	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	2	K4 (A)	Lecture, Group Discussion and Problem Solving	
	3.	Length contraction and time dilation – relativistic addition of velocities –	2	K3 (Ap)	Lecture, Group Discussion and Problem Solving	
	4.	Einstein's mass-energy relation – Minkowski's space	3	K3 (Ap)	Lecture, Group Discussion and Problem Solving	
	5.	four vectors – position, velocity, momentum, acceleration and force in for vector	3	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**

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	4	-	-	3	4	60	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: 60 (Including lectures, assignments and tests)

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

Head of the Department Course Instructor

Teaching Plan

Department : Physics
Class : I M.Sc. Physics
Title of the Course : Elective : Energy Physics
Semester : I
Course Code : PP231DE1

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
PP231DE1	4	-	-	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 (3 marks)

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 (7 marks)

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 : I M.Sc Physics
Title of the Course : Elective II A: Advanced Optics
Semester : I
Course Code : PP231GE1

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
PP231GE1	5	-	-	3	5	75	25	75	100

Objectives

1. To impart an extensive understanding of the optical phenomenon of various optical strategies like laser, fibre optics, non -linear optics and electro magneto optics.
2. To study the working of different types of Lasers and optical fibers

Course outcomes

COs	Upon completion of this course, students will be able to:	PSO addressed	CL
CO 1	Discuss the transverse character of light waves and different polarization phenomenon	PSO-1	K1
CO 2	Discriminate all the fundamental processes involved in laser devices and to analyze the design and operation of the devices	PSO-3	K2
CO 3	Demonstrate the basic configuration of a fiber optic – communication system and advantages	PSO-4	K3, K4
CO 4	Identify the properties of nonlinear interactions of light and matter	PSO-3	K4
CO 5	Interpret the group of experiments which depend for their action on an applied magnetics and electric field	PSO-2	K5

Teaching plan

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/Evaluation
I	**POLARIZATION AND DOUBLE REFRACTION**					
	1	Classification of polarization – Transverse character of light waves – Polarizer and analyzer – Malu's law	**3**	K2(U)	Lecture, Derivation and Group discussion, PPT	Evaluation through: Online quiz, short questions Descriptive answers MCQ, True/False, Concept explanations, Short summary or overview Formative assessment I
	2	Production of polarized light – Wire grid polarizer and the polaroid – Polarization by reflection	**4**	K4(An)	Concept Explanation, group discussion	
	3	Polarization by double refraction – Polarization by scattering – The phenomenon of double refraction – Normal and oblique incidence	**4**	K3(Ap)	Derivation, Theoretical formulation, Concept Explanation	
	4	Interference of polarized light: Quarter and half wave plates – Analysis of polarized light – Optical activity	**4**	K4(An)	Derivation, Theoretical formulation, Concept Explanation	
II	**LASERS**					
	1	Basic principles – Spontaneous and stimulated	**4**	K2(U)	Theoretical formulation, Concept	

		emissions – Components of the laser – Resonator and lasing action			Explanation, group discussion	Evaluation through: Online quiz, Short questions Descriptive answers Formative assessment I
	2	Types of lasers and its applications	**3**	K2(U)	Concept Explanation, group discussion	
	3	Solid state lasers – Ruby laser – Nd:YAG laser – gas lasers	**4**	K2(U)	Concept Explanation, group discussion, PPT	
	4	He-Ne laser – CO_2 laser – Chemical lasers – HCl laser – Semiconductor laser	**4**	K2(U)	Concept Explanation, group discussion, PPT	
III	**FIBER OPTICS**					
	1	Introduction – Total internal reflection – The optical fiber – Glass fibers – The coherent bundle	**3**	K2(U)	Derivation and Group discussion, Problem Solving	Evaluation through: Online quiz, Problem solving short questions Descriptive answers MCQ, True/False, Concept explanations, Short summary or overview Formative assessment I/II
	2	The numerical aperture – Attenuation in optical fibers – Single and multi-mode fibers	**4**	K3(Ap)	Derivation, Theoretical formulation Problem Solving	
	3	Pulse dispersion in multimode optical fibers – Ray dispersion in multimode step index fibers	**4**	K4(An)	Concept Explanation, group discussion, PPT	
	4	Parabolic-index fibers – Fiber-optic sensors: precision displacement sensor –	**4**	K4(An)	PPT, Theoretical formulation, Concept Explanation	

		Precision vibration sensor				
IV	**NON-LINEAR OPTICS**					
	1	Basic principles – Harmonic generation	**3**	K2(U)	Derivation discussion, Concept Explanation	Evaluation through: Online quiz, short questions Descriptive answers MCQ, True/False, Concept explanations, Short summary or overview Formative assessment II
	2	Second harmonic generation – Phase matching	**4**	K4(An)	Derivation discussion, Concept Explanation	
	3	Third harmonic generation – Optical mixing	**4**	K4(An)	Derivation discussion, Concept Explanation	
	4	Parametric generation of light – Self-focusing of light	**4**	K4(An)	Derivation discussion, Concept Explanation	
V	**MAGNETO OPTICS AND ELECTRO OPTICS**					
	1	Magneto-optical effects – Zeeman effect – Inverse Zeeman effect – Faraday effect	**4**	K5(E)	Derivation discussion, Concept Explanation	Evaluation through: Online quiz, short questions Descriptive answers MCQ, True/False, Concept explanations, Short summary or overview Formative assessment II
	2	Voigt effect – Cotton-mouton effect – Kerr magneto-optic effect	**4**	K4(An)	PPT, Theoretical formulation, Concept Explanation	
	3	Electro-optical effects – Stark effect – Inverse stark effect – Electric double refraction	**4**	K5(E)	PPT, Theoretical formulation, Concept Explanation	
	4	Kerr electro-optic effect –	**3**	K4(An)	Theoretical formulation	

		Pockels electro-optic effect			, Concept Explanation	

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: (Mention Topic and Type): **Comparing the polarisation by reflection and by double refraction- Through google classrooms**

Seminar Topic: (if applicable): **Problem Solving in Fibre Optics- descriptions through Google Classroom**

Sample questions (minimum one question from each unit)

Part A (1 mark)

1. Which of the following light waves fluctuate in one specific plane? **(K2- U, CO 1)**
   a) polarized b) unpolarized c) both d) none of these
2. What will be the wavelength of the Ruby laser source? **(K1- R, CO 2)**
   a) 6943 Å b) 6493 Å
   c) 6333 Å d) 6867 Å
3. Condition for total internal reflection is **(K2- U, CO 3)**
   (a) $\mu_1 > \mu_2$ (b) $\mu_1 < \mu_2$ (c) $\mu_1 = \mu_2$ (d) none of these
4. When the light was made to traverse the quartz crystal, Franken and his Co workers observed that the frequency of the UV light is _____the frequency of the ruby laser light **(K2- U, CO 4)**
   a) twice b) thrice
   c) four times d) halves
5. The stark effect is the splitting of spectral lines due to the action of an external electric field on the radiating substance. Say True or False **(K2- U, CO 5)**

Part B (3 marks)

1. How did a Nicol prism can act as a polarizer? **(K2- U, CO 1)**
2. Compare Spontaneous and stimulated emission process. **(K4- An, CO 2)**
3. Differentiate single mode and multimode fibre .**(K4- An, CO 3)**
4. Explain about parametric generation of light **(K4- An, CO 4)**

5. Calculate the wavelength separation between the unmodified line of wavelength 6000Å and the modified lines when a magnetic induction of 1 Wb/m^2 is applied in normal Zeeman effect. **(K3- Ap, CO 5)**

Part C (7 marks)

1. What is plane polarised light? Explain the phenomenon of double refraction. Describe the construction and working of a nicol prism. Discuss how you obtain a plane polarized beam with it **(K2- U, CO 1)**

2. Discuss the principle, construction and working of the Carbon di oxide Laser.

(K2- U, CO 2)

3. Discuss about the ray dispersion in multimode optical fibres. **(K4- An, CO 3)**

4.Explain the generation of second and third optical harmonic in crystals. **(K4- An, CO 4)**

5.Discuss the quantum mechanical explanation of the inverse Zeeman effect. **(K5- E, CO 5)**

Dr. R. Krishna Priya, Ms. S. Virgin Jeba, Dr. Jenepha Mary

Course Instructor

Dr. C. Nirmala Louis

Head of the Department

Teaching Plan

Department : Physics
Class : II M.Sc Physics
Title of the Course : Core VII: Electronics
Semester : III
Course Code : PP2031

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
PP2031	6	-	-	5	6	90	40	60	100

Objectives

- To impart in depth knowledge about Semiconductors, diodes, Transistors, Operational Amplifiers, Memories and converters etc
- To provide knowledge in the basic structure and working concepts of electronic devices.
- To acquire application skills involving digital integrated circuit.

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 diodes, transistor, op-amps, converter and interpret their applications	PSO-1	U
CO 2	Explain about the internal circuitry and logic behind semiconductor memory devices.	PSO-2	U
CO 3	Assess the working of diodes, transistor, op-amps and converters.	PSO-3	E
CO 4	Design various filter circuits.	PSO-6	C
CO 5	Interpret the Internal Architecture of memory devices	PSO-4	An

Teaching plan

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/Evaluation
I	**SemiconductorDiodes**					
	1	Introduction to Semiconductor - Intrinsic Semiconductor - Extrinsic Semiconductor	**4**	K1(R)	PPT, Illustration and theoretical derivation, Circuit designing	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	P-type- N-Type - PN Junction diode –Crystal Diode	**5**	K3(Ap)	Derivation and group discussion, Circuit designing	
	3	Zener diode- LED – Varactor Diode -Tunnel diode	**5**	K5(E)	PPT, Illustration, Theoretical formulation Circuit designing	
	4	Photo diode - schottky diode – Impatt diode- Characteristics and Applications.	**4**	K6(C)	Derivation and group discussion Circuit designing	
II	**Transistor Biasing and opto Electronic Devices**					
	1	Thevenin's and Norton's theorems	**5**	K2(U)	PPT, Derivation discussion Circuit designing	Evaluation through: Online quiz, Problem solving short questions Descriptive answers Formative assessment I
	2	Transistor action- PNP-NPN transistors – Transistor biasing and stabilization	**4**	K3(A)	Derivation and group discussion problem solving Circuit designing	
	3	Need for biasing- DC load line-	**5**	K4(An)	Illustration, Theoretical formulation	

		operating point- Bias stability-			Circuit designing	
	4	Two port Network - Hybrid model – h parameters — JFET – UJT- SCR	**4**	K5(E)	Derivation and group discussion problem solving Circuit designing	
III	**Operational Amplifier Applications**					
	1	Operational Amplifier- CMRR-Slew rate - Instrumentation amplifier – V to I and I to V converter – Op-amp stages	**5**	K2(U)	Derivation discussion Circuit designing	Evaluation through: Online quiz, Problem solving short questions Descriptive answers MCQ, True/False, Short essays, Concept explanations, Short summary or overview Formative assessment I/II
	2	Equivalent circuits - Sample and Hold circuits. Applications of Op-Amp: Inverting, Non-inverting Amplifiers- circuits	**5**	K3(Ap)	Illustration, Theoretical formulation Circuit designing	
	3	Adder- Subtractor- Differentiator- Integrator- Electronic analog Computation solving simultaneous and differential equation –. Schmitt Trigger – Triangular wave generator – Sine wave generator	**4**	K6(C)	Derivation and group discussion, PPT Circuit designing	
	4	Active filters: Low, High and Band pass first and second	**4**	K4(An)	PPT, Illustration, Theoretical formulation	

		order Butterworth filters – wide and narrow band reject filters.			Circuit designing	
IV	**Semiconductor Memories**					
	1	Classification of memories and sequential memory – Static Shift Register and Dynamic Shift Register	**4**	K1(R)	Derivation discussion Circuit designing	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	ROM, PROM and EPROM principle and operation Read & Write memory - Static RAM, dynamic RAM, Content Addressable Memory	**5**	K3(Ap)	Derivation and group discussion, PPT Circuit designing	
	3	Content Addressable Memory - principle, block diagram and operation. Programmable Logic Array (PLA) - Operation, Internal Architecture	**5**	K5(E)	Derivation and group discussion Circuit designing	
	4	Charge Couple Device (CCD) - Principle, Construction, Working and Data transfer mechanism.	**4**	K6(C)	Derivation and group discussion Circuit designing	
V	**A/D and D/A Converter**					
	1	Sampling theorem-Time division multiplexing – Quantization –	**4**	K2(U)	Discussion PPT Circuit designing	Evaluation through: Online quiz, Problem solving short questions

	2	DAC- Weighted resistor method – Binary Ladder network – ADC – successive approximation,	**5**	K1(R)	Derivation and group discussion, PPT Circuit designing	Descriptive answers MCQ, True/False, Short essays, Concept explanations, Short summary or overview Formative assessment II
	3	ADC Dual slope and Counter method	**5**	K3(Ap)	Derivation and group discussion Circuit designing	
	4	Voltage to Frequency conversion and Voltage to Time conversion .	**4**	K5(E)	Derivation and group discussion, PPT Circuit designing	

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

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

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

Activities related to Cross Cutting Issues :-

Assignment : (Mention Topic and Type): **Voltage to Time conversion – Circuit descriptions through Google Classroom**

Seminar Topic: (if applicable): **Exercise Problem solving and circuit designing**

Sample questions (minimum one question from each unit)

Part A (1 mark)

1. A semiconductor has _____ temperature coefficient of resistance. **(K2- U, CO 1)**
   a) positive b) negative
   c) zero d) infinite
2. The most commonly used transistor arrangement is _____arrangement. **(K4- An, CO 5)**
   a) common emitter b) common base
   c) common collector d) none of these
3. The OP-amp can amplify _____.**(K5- E, CO 3)**
   a) a.c. signals only b) d.c. signals only
   c) both a.c. and d.c. signals d) neither d.c. nor a.c. signals
4. Current cannot flow to ground through ____.**(K5- E, CO 3)**
   a) a mechanical ground b) an a.c. ground
   c)a virtual ground d) an ordinary ground

5. The number of resisters required for a five bit resister divider D/A Converter are 5. Say True or False **(K2- U, CO 1)**

Part B (3 marks)

6. What do you understand by intrinsic and extrinsic semiconductors? **(K5- E, CO 3)**
7. Write a note on DC load line **(K2- U, CO 1)**
8. Explain with diagram the working of an op-amp as an Integrator **(K2- U, CO 1)**
9. Explain the working of anAdder and Subtractorusing op-amp. **(K6- C, CO 4)**
10. Write a note on voltage to time conversion **(K4- An, CO 5)**

Part C(7 marks)

11. With proper diagram describe the principle, construction and working of Tunnel diode **(K6- C, CO 4)**
12. State and prove the Thevenin's theorem. **(K5- E, CO 3)**
13. With suitable circuit explain the construction and working of SCR **(K6- C, CO 4)**
14. Explain the working of active filters as low, high and band pass first and second order filters. **(K4- An, CO 5)**
15. Explain the construction and working of dual slope A/D Converter **(K5- E, CO 3)**

Ms.C.Nirmala Louis & Ms.Jenepha Mary

Head of the Department Course Instructor

Teaching Plan

Department : Physics
Class : II M.Sc Physics
Title of the Course : Core VI: Condensed Matter Physics
Semester : III
Course Code : PP2032

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
PP2032	**6**	**-**	**-**	**4**	**6**	**90**	**40**	**60**	**100**

Objectives

To develop analytical thinking to understand the phenomenon that decide various properties of solids thereby equip students to pursue higher learning confidently.

Course outcomes

COs	Upon completion of this course, students will be able to:	PSO addressed	CL
CO - 1	Understand the theory of dielectrics and analyze the dielectric properties of materials.	**PSO - 1**	**An**
CO - 2	Explain various types of magnetic phenomenon and their properties and applications.	**PSO - 4**	**E**
CO - 3	Elaborate the properties and applications of superconductors.	**PSO - 4**	**C**
CO - 4	Apply the obtained concepts to challenges in condensed matter physics	**PSO - 6**	**Ap**

Teaching plan

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

Unit	Module	Topic	Teaching Hours	Cognitive level	Pedagogy	Assessment/Evaluation
I	**Theory of Dielectrics:**					
	1	Dipole moment - Polarization - The electric field of a dipole - Local electric field at an atom - Clausius - Mosottiequation - Dielectric constants and its measurements	**4**	K1(R)	Lecture Discussion with PPT illustration	Evaluation through: Online quiz, Class test, Formative assessment I
	2	Polarizability - The Classical theory of electronic polarizability - Ionic polarizabilities - Orientational polarizabilities - The polarizability catastrophe	**4**	K2(U)	Lecture discussion with illustration, Derivation and group discussion	
	3	Dipole orientation in solids - Dipole relaxation and dielectric losses - Debye Relaxation time - Relaxation in solids	**4**	K3(Ap)	PPT Illustration	
	4	Complex dielectric constants and the loss angle - Frequency and temperature effects on Polarization - Dielectric breakdown and dielectric loss	**3**	K4(An)	Derivation and group discussion	

II	**Theory of Ferroelectrics and Piezo Electrics**					
	1	Ferroelectric Crystals - Classifications of Ferroelectric crystals - Dipole theory offerroelectricity - Landau Theory of the phase transition	**3**	K2(U)	Lecture discussion with illustration	Evaluation through: Online quiz, Short questions, Descriptive answers, Formative assessment I
	2	Second order Transition - First Order Transition - Ferroelectric Transition - One-Dimensional Model of the Soft Mode of Ferroelectric Transitions	**4**	K4(An)	Derivation and group discussion problem solving Circuit designing	
	3	Antiferroelectricity - Ferroelectric domains - Ferroelectric domain wall motion - Piezoelectricity	**3**	K2(U)	Lecture Illustration,	
	4	Phenomenological Approach to Piezoelectric Effects - Piezoelectric Parameters and Their Measurements - Piezoelectric Materials	**4**	K5(E)	Lecture Discussion	
III	**Magnetic properties of Materials:**					
	1	Terms and definitions used in magnetism - Classification of magnetic materials - Atomic theory of magnetism - The quantum	**4**	K2(U)	Illustration, discussion	Evaluation through: Online quiz, Short questions, Descriptive answers, Formative assessment I/II

		numbers				
	2	The origin of permanent magnetic moments - Langevin's classical theory of diamagnetism - Sources of paramagnetism - Langevin's classical theory of paramagnetism - Quantum theory of paramagnetism	**3**	K3(Ap)	Derivation and group discussion	
	3	Paramagnetism of freeelectrons - Ferromagnetism - The Weiss molecular field - Temperature dependence of Spontaneous magnetization	**4**	K4(An)	Derivation and group discussion, PPT Illustration	
	4	The physical origin of Weiss Molecular field - Ferromagnetic domains - Domain theory - Antiferromagnetism - Ferrimagnetism - Structure ofFerrite	**3**	K6(C)	Derivation And Lecture Illustration	
IV	**Superconductivity:**					
	1	Occurrence of super conductivity - Destruction of super conductivity by magnetic fields - Meissner Effect - Type I and Type II Super conductors	**4**	K1(R)	Derivation and discussion	Evaluation through: Online quiz, short questions, Descriptive answers, Formative assessment II
	2	Heat Capacity -	**3**	K2(U)	Derivation	

		Energy gap - Microwave and infrared properties - Isotope effect - Thermodynamics of the superconducting transition			and PPT	
	3	London equation - Coherence Length - BCS theory of superconductivity, BCS groundstate- Fluxquantization inasuperconductionring	**4**	K3(Ap)	Derivation and group discussion	
	4	Durationofpersistencecurrents- Single particle tunnelling - DC Josephson effect - AC Josephson effect - Macroscopic quantum interference - High temperature super conductors - Applications	**4**	K6(C)	Derivation and group discussion	
V	**Physics of Nanosolids:**					
	1	Definition of nanoscience and nanotechnology - Preparation of nanomaterials - Surface to volume ratio	**3**	K2(U)	Discussion And Illustration with PPT	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	Quantum confinement - Qualitative and Quantitative description - Density of states of nanostructures	**4**	K3(Ap)	Derivation and group discussion	
	3	Excitons in Nano	**4**	K2(U)	Lecture Illustration	

		semiconductors - Carbon in nanotechnology - Buckminsterfullerene - Carbon nanotubes				
	4	Nano diamond - BN nano tubes - Nanoelectronics - Single electron transistor - Molecular machine - Nanobiometrics	**4**	K3(Ap)	Lecture discussion with illustration	

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): Nil

Activities related to Cross Cutting Issues : Nil

Assignment : (Mention Topic and Type): **Frequency and temperature effects on Polarization**

Seminar Topic: (if applicable):

Sample questions (minimum one question from each unit)

Part A (1 mark)

1. The expression for induced dipole moment is _____ **(K4- An, CO1)**
2. The alpha graphene has the crystal structure of _____. **(K3 – Ap, CO4)**
   (a) Cubic (b) Rhombohedral (c) Triclinic (d) Hexagonal
3. Antiferromagnetic substance has the dipoles with equal moments, but the alternate dipoles point in opposite directions. **(True/False) (K5 – E, CO2)**
4. In all superconductors the entropy _____ on cooling below the critical temperature Tc. **(K6 – C, CO4)**
5. The two approaches used in the preparation of nanomaterials are _____ and _____.**(K3 – Ap, CO)**

Part B (3 marks)

6. Differentiate thermal and electrochemical breakdown with suitable example. **(K4 – An, CO1)**
7. Summarize the classification of ferroelectric crystals with suitable examples. **(K5 – E, CO2)**
8. Criticize the classification of magnetic materials based on their χ value. **(K5- E, CO2)**
9. Design DC Josephson effect in superconductors Tunneling. **(K6- C, CO4)**
10. Illustrate the concept surface to volume ratio in nanomaterils. **(K3 – Ap, CO4)**

Part C (7 marks)

11. Interpret the classical theory of electronic polarizability. **(K3 – Ap, CO4)**
12. Predict the concept of One-Dimensional Model of the soft mode of Ferroelectric Transitions. **(K5 – E, CO2)**
13. Write in detail the BCS theory of Superconductivity and Ground State. **(K6- C, CO4)**
14. Derive an expression for density of states of 3D bulk solid and idealized quantum wells. **(K3 – Ap, CO4)**
15. Explain in detail about paramagnetism of free electrons. **(K5- E, CO2)**

Sr.Sebastiammal & Ms.A.Lesly Fathima

Head of the Department — Course Instructor

Department : Physics
Class : II M.Sc. Physics

Title of the Course : Elective III b: MICROPROCESSORS AND MICROCONTROLLER
Semester : III
Course Code : PP2035

Course Code	L	T	P	Credits	Inst. Hours	Total Hours	Marks		
							CIA	External	Total
PP2035	6	-	-	4	6	90	40	60	100

Learning Objectives

1. To provide an extensive knowledge about the architecture and assembly language programming of microprocessors 8085 & 8086 and microcontroller 8051.
2. To gain hands on experience in interfacing of 8085 microprocessor.

Course Outcomes

COs	Upon completion of this course, students will be able to	PSOs addressed	CL
CO-1	Identify/ Explain the operation of various components of the microprocessor 8085 and microprocessor 8086	**PSO-1**	**K3(An)**
CO-2	Relate and explain the various addressing modes and the instruction set of 8085 microprocessor	**PSO-1**	**K1(R)**
CO-3	Develop skill in writing simple programs for 8085 microprocessor	**PSO-2**	**K6(C)**
CO-4	Explain the architecture of 8051 microcontroller	**PSO-1**	**K2(U)**
CO-5	Understand the various interrupts of 8085 microprocessor	**PSO-2**	**K2(U)**

Modules

Credits: 4 Total contact hours: 90 (Including assignments and tests)

Unit	Section	Topics	Lecture hours	Cognitive Level	Pedagogy	Assessment/ Evaluation
I	**Microprocessors 8085 Architecture**					
	1	Intel 8085 microprocessor : Introduction – Pin configuration- Architecture and its operations	5	K1 (R)	Lecture using chalk and talk, Discussion with PPT, mind mapping	Evaluation through: short test Class Test Multiple choice questions Quiz Formative assessment Short Summary or Overview
	2	Machine cycles of 8085- Interfacing of memory and I/O devices	4	K4 (An)	Lecture using videos, Problem solving	
	3	Instruction classification: number of bytes, nature of operations-	5	K2 (U)	Demonstration, Peer tutoring, Problem solving, Review	
	4	Instruction format- Vectored and non-vectored interrupts	3	K2 (U)	Demonstration, Peer tutoring, Problem solving, Review	
II	**8085 Assembly Language Programming**					
	1	Instruction set: Data transfer operations - Arithmetic operations	4	K4 (An)	Demonstration, Peer tutoring, Problem solving,	Evaluation through: Short test Quiz

					Review Discussion with PPT, mind mapping	Assignment Formative assessment Class test Open book test, Practical.
	2	Logical operations- Branching and machine control operations -	4	K4 (An)	Demonstration, Peer tutoring, Problem solving, Review, Discussion with PPT, mind mapping	
	3	Addressing modes Writing assembly language programs: Looping, counting and indexing	5	K6 (C)	Demonstration, Peer tutoring, Problem solving, Review, mind mapping	
	4	Stack – subroutine- Translation from assembly language to machine language	5	K6 (C)	Demonstration, Peer tutoring, Problem solving, Review	
III	**Microprocessor 8086**					

	1	Intel 8086 microprocessor: Introduction – Architecture - Pin configuration	5	K2 (U)	Lecture using chalk and talk, Discussion with PPT, mind mapping	Evaluation through: Class test Quiz Multiple choice questions Formative assessment Practical
	2	Operating modes: Minimum mode, Maximum mode.	3	K2 (U)	Lecture using videos, Problem solving	
	3	Memory addressing: 8-bit data from even and odd address bank, 16-bit data from even and odd address bank- Addressing modes	5	K4 (An)	Lecture using videos, Demonstration, Peer tutoring, Problem solving, Review.	
	4	Interrupts: Hardware interrupts – Software interrupts –Interrupt priorities- Simple programs.	5	K4 (An)	Demonstration, Peer tutoring, Problem solving, Review	
IV	**Microcontroller 8051 Architecture and Programming**					
	1	Introduction to microcontroller and embedded system- Difference between microprocessor and microcontroller	4	K4 (An)	Lecture using chalk and talk, Discussion with PPT, mind mapping	Evaluation through: Class test Quiz Short test Formative assessment II Practical

	2	8051 microcontroller: Pin configuration, Architecture and Key features. 8051 Data types and directives	5	K1 (R)	Lecture using videos, Problem solving	
	3	Instruction set: Data transfer instructions - Arithmetic instructions – Logical instructions-	4	K4 (An)	Demonstration, Peer tutoring, Problem solving, Review	
	4	Branching instructions- Single bit instructions. Addressing modes- Simple programs using 8051 instruction set.	5	K4 (An)	Demonstration, Peer tutoring, Problem solving, Review	
V	**Interfacing of Microprocessor 8085**					
	1	Basic concepts of programmable device - 8255 Programmable Peripheral Interface (PPI)	6	K2 (U)	Lecture using chalk and talk, Discussion with PPT, mind mapping	Evaluation through: Short test Class test Open book test Quiz Assignment Formative assessment III
	2	interface of ADC and DAC-8257 Direct Memory Access (DMA) controller	6	K6 (C)	Lecture using videos, Problem solving	

	3	Basic concepts of serial I/O and data communication – interface of 8251 Universal Synchronous Asynchronous Receiver Transmitter (USART)	6	K4 (An)	Demonstration, Peer tutoring, Problem solving, Review, Lecture using videos.	

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

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

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

Activities related to Cross Cutting Issues :-

Assignment : (Mention Topic and Type): **Application of Microprocessor in day to day Life – Google Docs and Sheets**

Seminar Topic: (if applicable): **Difference between Microprocessor and Microcontroller**

Sample questions

Part A (1 mark)

Answer all the questions

1. Classify the 8085 instruction set according to the word size.**(K2-U, CO 3)**
2. The _____ is an area of memory identified by the programmer for temporary storage of information.**(K1- R, CO 2)**

   (a) Stack (b) subroutine (c) opcode (d) operand
3. Which pin has to be made low for the maximum mode of operation to occur in 8086 microprocessor?**(K1-R, CO 2)**
4. Choose the correct function of the instruction "JNC target" in 8051 microcontrollers.

   (K2-U, CO 4)

   (a) Jump to target if zero flag is set (b) Jump to target if zero flag is reset

   (c)Jump to target if carry flag is set (d) Jump to target if carry flag is reset
5. Expansion of USART is_____ **(K1- R, CO 2)**

   (a) Universal Set And Reset Transmitter

   (b) Universal Synchronous Asynchronous Receiver Transmitter

   (c) United Set And Reset Transmitter

(d) United Synchronous Asynchronous Receiver Transmitter

Part B (3 marks)

1. Analyzethe operation of the Subroutine with a neat diagram.**(K4-An, CO 1)**
2. Construct a program to do the following.**(K6- C, CO 3)**
   (i) Load the number 30H in register B and 39H in register C.
   (ii) Subtract 39H from 30H.
   (iii) Display the answer at PORT 1.
3. Explain the minimum mode operation of 8086.**(K1-R, CO 2)**
4. Explain the following instructions of 8051 with example. **(K2-U, CO 4)**
   (i) ADDC (ii) SUBB
5. Distinguish different operating modes of 8255.**(K4-An, CO 1)**

Part C (7 marks)

1. Analyze the architecture of 8085 microprocessorwith a schematic diagram.**(K4-An, CO1)**
2. Formulate assembly language programs to set time delay using one register and a register pair. Also calculate the time delay using one register if the register is loaded with the count FFH.**(K6- C, CO 3)**
3. With a neat diagram explain the pin description of 8086. **(K2-U, CO 1)**
4. Discuss the different addressing modes of 8051 microcontroller with examples.**(K6- C, CO 3)**
5. Examine in detail about the principle and working of USART.**(K4-An, CO 1)**

Ms. S. Virgin Jeba & Dr. P.Aji Udhaya

Head of the Department Course Instructor