CAUVERY COLLEGE FOR WOMEN (AUTONOMOUS)

NATIONALLY ACCREDITED (IIICYCLE) WITH "A" GRADE BY NAAC

ISO 9001:2015 Certified

TIRUCHIRAPPALLI

PG & RESEARCH DEPARTMENT OF PHYSICS

M.Sc., PHYSICS SYLLABUS

2022-2023 and Onwards

CAUVERY COLLEGE FOR WOMEN (AUTONOMOUS), TRICHY-18.

PG AND RESEARCH DEPARTMENT OF PHYSICS

VISION

To establish a substratum for excellence and creation of knowledge by igniting the essence of learning physics and exploring its area of research with novel ideas.

MISSION

Our mission is two – fold.

- To provide an outstanding and distinctive education to our undergraduate and postgraduate students.
- To expand our research enterprises via centers and institutes to achieve national and international prominence in strategic research areas.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

PEOs	Statements
PEO1	**LEARNING ENVIRONMENT** To facilitate value-based holistic and comprehensive learning by integrating innovative learning practices to match the highest quality standards and train the students to be effective leaders in their chosen fields.
PEO2	**ACADEMIC EXCELLENCE** To provide a conducive environment to unleash their hidden talents and to nurturethe spirit of critical thinking and encourage them to achieve their goal.
PEO3	**EMPLOYABILITY** To equip students with the required skills in order to adapt to the changing global scenario and gain access to versatile career opportunities in multidisciplinary domains.
PEO4	**PROFESSIONAL ETHICS AND SOCIAL RESPONSIBILITY** To develop a sense of social responsibility by formulating ethics and equity to transform students into committed professionals with a strong attitude towards the development of the nation.
PEO5	**GREEN SUSTAINABILITY** To understand the impact of professional solutions in societal and environmental contexts and demonstrate the knowledge for an overall sustainable development.

PROGRAMME OUTCOMES FOR M.Sc PHYSICS PROGRAMME

PO NO.	Programme Outcome On completion of M.Sc., Physics Programme, The students will be able to
PO 1	**Problem Analysis:** Provide opportunities to develop innovative design skills, including the ability to formulate problems, to think creatively, to synthesize information, and to communicate effectively.
PO 2	**Scientific Skills:** Create and apply advanced techniques and tools to solve thesocietal environmental issues.
PO 3	**Environment and sustainability:** Ascertain eco- friendly approach for sustainable development and inculcate scientific temper in the society.
PO 4	**Ethics:** Imbibe ethical and social values aiming towards holistic development oflearners.
PO5	**Lifelong learning:** Instill critical thinking, communication, initiative which potentially leads to higher rates of employment and educational fulfillment.

PROGRAMME SPECIFIC OUTCOME FOR M.Sc., PHYSICS PROGRAMME M.Sc., PHYSICS CURRICULUM (2022-2023 and onwards)

PSO NO.	Programme Specific Outcomes Students of M.Sc., Physics will be able to	POs Addressed
PSO1	Demonstrate proficiency in the mathematical concepts needed for a proper understanding of Physics	**PO1,PO2, PO5**
PSO2	Understand the basic concepts of Physics particularly concepts in classical mechanics, quantum mechanics, electrodynamics and electronics to appreciate how diverse phenomena observed in nature follow from a small set of fundamental laws.	**PO2, PO5**
PSO3	Learn numerous numerical problem-solving approaches and the fundamentals of curve fittings.	**PO1, PO2**
PSO4	Learn about microprocessors and microcontrollers, as well as practical microprocessor programming abilities	**PO1, PO2**
PSO5	Provide students with broad theoretical and practical knowledge in all specialization of Physics with required qualitative and quantitative techniques.	**PO1, PO2 PO5**

Cauvery College for Women (Autonomous)PG & Research Department of Physics
M.Sc., Physics
LEARNING OUT COMES BASED CURRICULUM FRAMEWORK (CBCS–LOCF)

(For the Candidates admitted from the Academic year 2022-2023 onwards)

Semester	Course	Course Title	Course Code	Inst. Hrs./ week	Credits	Exam			Total
						Hrs.	Marks		
							Int.	Ext.	
I	Core Course–I(CC)	Mathematical Physics	22PPH1CC1	6	5	3	25	75	100
	Core Course– II(CC)	Classical Dynamics and Relativity	22PPH1CC2	6	5	3	25	75	100
	Core Course –III(CC)	Quantum Mechanics-I	22PPH1CC3	6	5	3	25	75	100
	Core Practical-I (CP)	General Physics and Electronics-I(P)	22PPH1CC1P	6	5	3	40	60	100
	Discipline Specific Elective Course-I(DSE)	Microprocessor and Microcontroller	22PPH1DSE1A	6	3	3	25	75	100
		Non–Destructive Evaluation Techniques	22PPH1DSE1B						
		Astrophysics	22PPH1DSE1C						
	Total			30	23	-	-	-	**500**
	15 Days INTERNSHIP during Semester Holidays								
II	Core Course–IV(CC)	Electromagnetic Theory	22PPH2CC4	6	5	3	25	75	100
	Core Course– V(CC)	Quantum Mechanics-II	22PPH2CC5	6	5	3	25	75	100
	Core Choice Course– I(CCC)	Electronics	22PPH2CCC1A	6	4	3	25	75	100
		Nonlinear Dynamics	22PPH2CCC1B						
		Spectroscopy	22PPH2CCC1C						
	Core Practical-II(CP)	Microprocessor and Python Programming (P)	22PPH2CC2P	6	5	3	40	60	100
	Discipline Specific ElectiveCourse-II (DSE)	Numerical Methods and Python Programming	22PPH2DSE2A	6	3	3	25	75	100
		Physics of Sensor and Transducer	22PPH2DSE2B						
		Material Characterization and Measurement Techniques	22PPH2DSE2C						
	Internship	Internship	22PPH2INT	-	2	-	25	75	100
	Extra Credit Course	SWAYAM	As per UGC Recommendation						
	Total			30	24	-	-	-	**600**

III	Core Course–VI(CC)	Statistical Mechanics	22PPH3CC6	6	5	3	25	75	100
	Core Course – VII(CC)	Solid State Physics	22PPH3CC7	5	5	3	25	75	100
	Core Choice Course–II(CCC)	Cyber Security	22PGCS3CCC2A	3T + 2P	4	3	25	75	100
		Communication Electronics	22PPH3CCC2B	5					
		Physics of Semiconductor Devices	22PPH3CCC2C						
	Core Practical-III(CP)	General Physics and Electronics-II(P)	22PPH3CC3P	6	5	3	40	60	100
	Discipline Specific Elective Course-III(DSE)	Physics for Competitive Examinations	22PPH3DSE3A	5	3	2	-	100	100
		Crystal Growth and Thin Film Physics	22PPH3DSE3B			3	25	75	
		Weather Forecasting	22PPH3DSE3C			3	25	75	
	Generic Elective Course –I (GEC)	Science of Materials	22PPH3GEC1	3	2	3	25	75	100
	Extra Credit Course	SWAYAM	As per UGC Recommendation						
	Total			30	24	-	-	-	**600**
IV	Core course – VIII(CC)	Nuclear and Particle Physics	22PPH4CC8	6	5	3	25	75	100
	Core Choice Course - III(CCC)	Advanced Optics and Spectroscopy	22PPH4CCC3A	6	4	3	25	75	100
		Nanophysics	22PPH4CCC3B						
		Space Physics	22PPH4CCC3C						
	Core Practical -IV(CP)	Electronics (P)	22PPH4CC4P	6	5	3	40	60	100
	Generic Elective Course -II (GEC)	Trouble Shooting and Repairing Domestic Appliances	22PPH4GEC2	3	2	3	25	75	100
	Project	Project Work	22PPH4PW	9	5	-	-	100	100
	Total			30	21	-	-	-	500
	Grand Total			120	92				2200

COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
22PPH1CC1	MATHEMATICAL PHYSICS	CC - I	6	5

Course Objectives

- To provide a strong mathematical foundation in vector calculus, matrices and Differential equations
- To learn complex variables and residue theorem technique to solve real integrals appearing inphysics problems
- To understand basics of Fourier Transform and Laplace Transform.
- To demonstrate competence with the basic ideas of linear algebra including concepts of linear systems, theory of matrices, , eigenvectors and diagonalization.
- To enhance problem solving skills and to give the ability to formulate, interpret and drawinferences from the mathematical solutions.

Pre-requisites

- Strong Foundation of vector Analysis.
- Understand and appreciate the properties of complex variable.
- Commendable knowledge of special functions to apply physics problems.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO 1	Remember and Understand the various mathematical concepts used in physics.	K1, K2
CO 2	Analyze mathematical tools like vector, matrix, group theory, complex integration, Fourier and Laplace series, special function will prepare the student to solve ODE; PDE's which model physical phenomena.	K3
CO 3	Evaluate the vector, linear, simultaneous and differential equations which will be necessary to pursue other areas in physics.	K4
CO 4	Apply mathematical methods to predict the problems in classical physics, statistical physics and quantum mechanics as well as electrodynamics.	K5
CO 5	Solve the physical problems using mathematical techniques.	K6

Mapping of CO with PO and PSO

Cos	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	1	2	1	1	3	3	2	2	2
CO 2	3	1	1	1	1	3	1	2	2	2
CO 3	3	1	1	1	1	3	3	1	2	2
CO 4	3	1	3	1	1	1	3	2	2	2
CO 5	3	1	2	1	1	3	3	2	3	1

"1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation;
"3" – Substantial (High) Correlation "-" indicates there is no correlation.

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**Vector Analysis** Vector integration – Line integral– Surface integral – Flux – Volume integral – Green's theorem – Stokes' theorem – Divergence theorem – Orthogonal curvilinear coordinates – Unit vectors in curvilinear coordinate system – The gradient, divergence, curl and Laplacian in cylindrical and spherical polar coordinates.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**Matrix and Group theory** Characteristic equation of a matrix – Matrix algebra – Rank of a Matrix – System of linear equations –Types of matrix – Inverse of a matrix – Eigenvalues and eigenvectors – Cayley–Hamilton theorem – Reduction of a matrix to diagonal form – Jacobi method. Introduction to Group Theory – Group Multiplication Table – Cyclic Group – Subgroup – Cosets – Classes – Invariant Subgroup – Homomorphism and Isomorphism – Reducible and Irreducible Representation – Formation of character table of C_{2v}– SU(2) and SO(3)	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**Complex Variables** Complex functions and variables – Condition for a function to be analytic– Complex integration – Cauchy's theorem – Taylor expansion – Laurent series – Cauchy's residue theorem – Computations of residue – Evaluation of integrals using residues.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**Fourier and Laplace's Integral Transforms** Fourier's Transform– Infinite Fourier Sine and Cosine Transforms– Properties of Fourier's Theorem– Finite Fourier sine and cosine transforms. Laplace transforms– Properties of Laplace Transforms– Convolution Theorem– Evaluation of Inverse Laplace Transforms by Convolution Theorem– Evaluation of Laplace Transform using Differential Equations.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	**Special Functions** Solution of Differential Equations – Legendre, Hermite and Bessel Differential Equations using Power Series method – Generating Function, Rodrigues Formula, Recurrence relation, Orthogonality relations.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

VI	**Self-Study for Enrichment (Not included for End Semester Examinations)** Exact differential –Sylvester's theorem–Formation of character table of C_{3v}– Elementary ideas in Lie Groups and Lie Algebras –Cauchy's integral formula– Simple applications of Fourier Transforms– Laguerre differential equation.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Gupta.B.D., (2015). *Mathematical Physics*. (2nd Edition)Vikas Publishing House, Mumbai.
2. Satya Prakash., (2014). *Mathematical Physics*.(1st Edition) Sultan chand & sons, New delhi.
3. Sexena.A.K., (2015). *Mathematical Physics.*(1st Edition) Narosa Pub, New delhi.
4. Joshi.A.W., (2006). *Matrices and Tensors in Physics*. (4th Edition)New Age, New delhi.
5. MurraySpiegel., (2009). *Schaum Series of Complex.* (2nd Edition) *Analysis* .McGraw-Hill, Newyork.
6. Balakrishnan.V., (2018). *Mathematical Physics with Applications*. Indian Academy of Science, Bangalore.

Reference Books

1. Dass, H.K., & Rama Verma., (2018).*Mathematical Physics*.(1st Edition) S.Chand & Co, New Delhi.
2. Pipes, L.A.,& Harvill,L.R., (1970).*Mathematical Physics for Engineering*.(3rd Edition) McGraw-Hill, Newyork.

Web References

1. https://nptel.ac.in/courses/115/106/115106086/
2. https://nptel.ac.in/courses/115/103/115103036/
3. https://www.classcentral.com/course/swayam-mathematical-methods-in-physics-1-23045

Pedagogy

Chalk and Talk, Seminar, Assignment, Power point Presentation, Group discussion and Quiz

Course Designer

Dr.R.Gayathri

SEMESTER - I	INTERNAL MARKS : 25	EXTERNAL MARKS : 75		
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
22PPH1CC2	CLASSICAL DYNAMICS AND RELATIVITY	CC - II	6	5

Course Objectives

- To acquire Basic Knowledge about Lagrangian formulation
- To expose the students to the fundamentals of Hamiltonian equation.
- To demonstrate knowledge and understanding of the fundamental concepts of Rigid body dynamics
- To acquire knowledge of real time problems in macroscopic view and applying it to the microscopic level
- To develop critical thinking and problem solving skills

Pre-requisites

- Knowledge about Lagrange's equation
- Knowledge about Motion under a central force
- Fundamental knowledge of physical concepts , mathematical methods of classical mechanics

Course Outcome and Cognitive Level Mapping:

CO Number	CO Statement On the successful completion of course, the student will be able to	Cognitive Level
CO 1	Remember and Understand the primary idea and principle governing the concept of tensor as well as the discrete and continuous mechanical systems related concepts in classical mechanics.	K1,K2
CO 2	Analyze the constraints on mechanical systems and Interpret the importance of concepts such as generalized coordinates.	K3
CO 3	Evaluate the ideas of rigid body dynamics and kinematics as well as the central force acting on the objects.	K4
CO 4	Apply the Lagrangian and Hamiltonian formulation of classical mechanics, poisson brackets and canonical transformations are used in order to simplify the methods to be used in solving physics problems.	K5
CO 5	Create conclusions about classical dynamics, including matrix generalization and special relativity.	K6

Mapping of CO with PO and PSO

COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	2	1	3	3	2	2	2	2
CO 2	3	3	2	1	3	3	2	2	2	2
CO 3	3	3	2	1	3	3	2	2	2	2
CO 4	3	3	2	1	3	3	2	2	2	2
CO 5	3	3	2	1	3	3	2	2	2	2

"1"-Slight (Low) Correlation "2"-Moderate (Medium) Correlation
"3"- Substantial (High) Correlation "-"indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**Lagrangian Formalism:** Mechanics of a system of particles – Conservation of linear momentum, Angular momentum and Energy-constraints – Classification of constraints – Degrees of freedom – Generalized coordinates – Principle of virtual work – D'Alembert's principle – Lagrange's equation of motion – Applications – Linear harmonic oscillator – Simple Pendulum – Compound Pendulum – Atwood's Machine.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**Hamilton's Formulation:** Phase space and motion of the system -Hamiltonian function – Hamiltonian Variation principle – Hamilton's canonical equations of motion – physical significance of H – advantages of Hamiltonian approach – Applications of Hamilton's equations of motion – Simple Pendulum – Principle of least action- Canonical Transformations- Infinitesimal constant transformations- Poisson brackets -Equation of motion in Poisson brackets and its relation	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**Central Force Problems:** Equations of motion and first integrals - The equivalent One - Dimensional problem and General features of orbits - The Kepler problem: Inverse square law of force-the Laplace-Runge - Lenz Vector – Scattering in a central force field - Scattering in a Problem to laboratory coordinates	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**Rigid Body Dynamics and Oscillatory Motion:** Euler angles - Moments and Products of inertia - Euler's equations – Symmetric top under the action of gravity -Applications-Theory of small Oscillations and normal modes-Frequencies of free Vibration and normal coordinates-Linear triatomic molecule.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	**Tensor and Relativistic Mechanics:** Occurrence of tensor in physics-Kronecker delta-Dummy and Free index-Covariant and Contravariant-Inner and Outer Product- Quotient Law-Basic Postulates of special theory of relativity-Lorentz transformationsin real four dimensional spaces, force and energy equations in relativistic mechanics- Lagarangian formulation of relativistic mechanics-Hamiltonian formulation of relativistic mechanics	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	**Self Study for Enrichment (Not included for End Semester Examinations)** Superiority of Lagrangian approach over Newtonian approach-Application of Lagrangian and Hamiltonian: motion in a Uniform gravitational field-Advantage of Hamiltonian approach-Advantage of Canonical transformation-Relation between Lagrange and Poisson brackets-One dimensional harmonic oscillator- Special theory of relativity- Relativistic Generalization of Newton's laws.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Herbert Goldstein., (2001) *Classical Mechanics,* Narosa Publishing House , 2nd Edition, New Delhi.

2. Upadhyaya J.C.,(2015) *Classical Mechanics,* Himalaya Publishing House.

3. Gupta, Kumar &Sharma .,(2012) *Classical Mechanics,* PragatiPrakashan, India.

4. Takwale R G &Puranik P S .,(2010) *Classical Mechanics,* Tata McGraw Hill Education Pvt. Ltd Noida.

5. Joshi A.W.,(2002) *Matrices and Tensors in Physics*,New Ag International(P)Ltd.,Publishers,Newdelhi.

Reference Books

1. Rana N.C. and Joag P. S (1998) *Classical Mechanics,* Tata McGraw Hill, New Delhi.

2. Douglas Gregory (2008) *Classical Mechanics,*University press , Cambridge.

Web Resources

1. https://sites.astro.caltech.edu/~golwala/ph106ab/ph106ab_notes.pdf
2. http://users.uoa.gr/~pjioannou/mechgrad/chapter3_Goldstein.pdf
3. http://www.cds.caltech.edu/~marsden/wiki/uploads/projects/geomech/Alemicds205final.pdf
4. https://www.physics.rutgers.edu/~shapiro/507/book7.pdf
5. https://phys.libretexts.org/Bookshelves/Classical_Mechanics/Classical_Mechanics_(Tatum)/04%3A_Rigid_Body_Rotation/4.08%3A_Force-free_Motion_of_a_Rigid_Symmetric_Top
6. https://byjus.com/jee/what-is-cartesian-coordinate-system/
7. https://phys.libretexts.org/Bookshelves/Classical_Mechanics/Variational_Principles_in_Classical_Mechanics_(Cline)/17%3A_Relativistic_Mechanics

Pedagogy

Lecture, Seminar, Assignment and power point presentation

Course Designer

Ms.R.A.Kiruthika

SEMESTER- I	INTERNAL MARKS : 25	EXTERNAL MARKS : 75		
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
22PPH1CC3	QUANTUM MECHANICS - I	CC-III	6	5

Course Objectives

- To study the fundamentals of wave mechanics.
- To study the stationary state and eigen spectrum of systems using time dependent Schrodinger equation.
- To solve the exactly soluble eigen value problems.
- To know the matrix formulation of quantum theory and how it can be used to understand the equation of motion.
- To understand the theory of identical particles and angular momentum.

Pre-requisites

- A thorough understanding of mechanics.
- Knowledge of partial differential equation and variable separable method.
- Commendable knowledge of integral and differential calculus.

Course Outcomes and Cognitive Levels Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO1	Recall and interpret the classical and quantum mechanics	K1,K2
CO2	Analyze the various applications of quantum mechanics	K3
CO3	Discover the formalism in quantum mechanics	K4
CO4	Apply the different type of approaches to solve quantum mechanical systems	K5
CO5	Elaborate the operators in both classical and Quantum Mechanics	K6

Mapping of CO with PSO and PO

COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO 1	PO 2	PO 3	PO 4	PO 5
CO1	3	3	3	1	2	3	3	3	3	3
CO2	3	3	3	1	3	3	3	3	3	3
CO3	3	3	3	1	3	2	2	3	2	2
CO4	3	3	2	1	2	1	1	1	1	1
CO5	3	3	2	1	3	3	3	3	3	3

"1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation;
"3" – Substantial (High) Correlation "-" – Indicates there is no correlation.

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**SCHRÖDINGER EQUATION APPROACH** Recapitulation of the need for Quantum Mechanics - Thought experiments using Young's double slit -Motivation to introduce a wave function-probabilistic interpretation and Normalization - Time dependent Schrödinger equation (free particle in one dimension) - Generalization to three dimension - Non-normalizablewavefunction and Box normalization - Expectation values: Ehrenfest theorem - Conditions on the wave function-The time-independent Schödinger equation. **APPLICATIONS** Particle in a square well potential - Solution of wave equation in bound states - Energy Eigenvalues - Energy Eigenfunctions - Square potential barrier: Quantum mechanical tunnelling - Reflection at potential barrier and walls -The free particle - Deutron	20	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**ABSTRACT FORMALISM- I** Linear vector space - linear operator - Eigenfunctions - Eigenvalues - Hermitian operator- - Commutation relations- Their connection with Poisson Brackets of Classical Mechanics - Properties of Unitary operator- Postulates of quantum mechanics - Observables and their connection with Hermitian operators	17	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**ABSTRACT FORMALISM- II** Uncertainty relation – Dirac's notation - Equation of motion - Momentum representation - Heisenberg method: Matrix representation of quantum states and operator-Properties of matrix element – Evolution of Schrodinger equation in matrix form - Unitary transformation-Linear harmonic oscillator in matrix form.	17	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

IV	**SIMPLE HARMONIC OSCILLATOR** **Wave-function approach:** Schrödinger equation and Energy eigenvalues - Energy eigenfunctions: Series Solution; Asymptotic behavior- Orthonormality - Properties of stationary states **Abstract Operator Approach:** Formulation of Harmonic oscillator problem in abstract notation - Creation, Annihilation and number operators- Solving the Eigen value problem in Abstract Notation - Eigen states and Energy eigenvalues	17	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	**ANGULAR MOMENTUM** **Wave-function approach:** Angular momentum operators – Commutations relations of Angular momentum - Eigenvalues and eigenfunctions of L^2 andL_z- Separation of variables- Admissibility conditions on solutions - Spherical harmonics - Physical interpretation - Angular Momentum in Stationary States of Systems with Spherical Symmetry **Abstract Operator Approach:** Constructing the Operators for J^2 andJ_z - Raising and lowering operators - Eigenvalues of J^2 and J_z - Angular momentum matrices -Spin angular momentum – Addition of angular momentum- Clebsch Gordon Coefficients – Selection rules – Recursion relations - Computation of Clebsch Gordon Coefficients	19	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	**Self Sstudy for Enrichment** **(Not included for End Semester Examination)** De Broglie's Hypothesis-Interpretation of the Wave-Particle Dualism - Photons: The Quantization of Fields -Alpha emission-Coherent state- Parity.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Mathews P. M.,andVenkatesan K.,.(1987),*A Text Book of Quantum Mechanics*,Tata McGraw Hill, New Delhi.
2. Aruldhas G., (2009),.*Quantum Mechanics*,Prentice Hall of India.
3. Ghatak .A., and Lokanathan S., (1987),*A Text Book of Quantum Mechanics*.Tata McGraw Hill, New Delhi.
4. EugenMerzbacher., (1998),*Quantum Mechanics*, John Wiley &Son,Inc,Newyork

Reference Books

1. DevanathanV.,(2006) *Quantum Mechanics*,Narosa Publishing House, New Delhi
2. Scfiff .L.,(2004) *Quantum Mechanics*,Tata McGraw Hill, New Delhi
3. Shankar.R., (2007),*Principles of Quantum Mechanics*,Springer, New Delhi
4. Thankappan V.K., *Quantum*Mechanics., Wiley Eastern Ltd, New Delhi

Web References

1. https://www.britannica.com/science/quantum-mechanics-physics
2. https://www.livescience.com/33816-quantum-mechanics-explanation.html
3. https://plato.stanford.edu/entries/qm/

Pedagogy

Chalk and Talk ,Lecture, Seminar, Assignment, Power point presentation

Course Designer

Dr.R.MEENAKSH

SEMESTER-I	INTERNAL MARKS: 40	EXTERNAL MARKS: 60		
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
22PPH1CC1P	GENERAL PHYSICS AND ELECTRONICS-I(P)	CP-I	6	5

Course Objectives

- To determine certain physical constants
- Demonstrate the concepts of spectrometry and to find optical constants
- Explore the concepts of electrical discharge in applied magnetic field
- Explain the operation of IC 555 timer as multivibrators
- To understand properties and characteristics of electronic components and devices

Pre-requisites

- Fundamental knowledge of Physical and optical constants
- Understand the concepts of specific charge of an electron by Magnetron method
- Experimental knowledge of IC 555 timers as multivibrators

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO 1	Explain the basics of experimental physics.	K2
CO 2	Understand the fundamental physics behind many scientific discoveries through hands on experience.	K2
CO 3	Explore the concepts of spectrometry involved in the optic processes.	K3
CO 4	Verify experimentally the basic laws of physics	K4
CO 5	Develop the skill in handling instruments in the construction of circuits	K6

Mapping of CO with PO and PSO

COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	1	2	1	2	2	3	2	1	2	1
CO 2	1	3	2	3	1	3	3	2	2	1
CO 3	3	3	2	3	2	3	2	3	3	2
CO 4	2	3	2	3	3	2	3	2	3	2
CO 5	3	2	3	3	3	2	2	2	3	2

"1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation

"3" – Substantial (High) Correlation "-" indicates there is no correlation.

SYLLABUS

LIST OF EXPERIMENTS (Any 10)	Hours	COs	COGNITIVE LEVEL
1. DETERMINATION OF Q, N, Σ BY ELLIPTICAL FRINGES METHOD 2. DETERMINATION OF RYDBERG'S CONSTANT USING SPECTROMETER 3. .DETERMINATION OF WAVELENGTH BY USING MICHELSON'S INTERFEROMETER. 4. CHARGE OF AN ELECTRON BY SPECTROMETER 5. STUDY OF HALL EFFECT IN A SEMICONDUCTOR 6. DETERMINATION OF E/M OF ELECTRON BY MAGNETRON METHOD 7. DESIGN AND STUDY OF ASTABLE AND MONOSTABLE MULTIVIBRATORS USING IC555 8. DESIGN AND STUDY OF WEIN BRIDGE OSCILLATOR 9. DESIGN AND STUDY OF PHASE SHIFT OSCILLATOR 10. OPERATION OF SHIFT REGISTER USING SISO, SIPO, PIPO 11. DESIGN OF REGULATED POWER SUPPLY 12. FREQUENCY DIVIDER USING IC 555. 13. CHARACTERISTICS OF SCR/CHARACTERISTICS OF DIAC/CHARACTERISTICS OF TRIAC	6 Hrs Week	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Ouseph, C.C., Rao, U.J., & Vijayendran, V., (2009). *Practical Physics and Electronics*. S.Viswanathan, Printers & Publishers Pvt Ltd.
2. Dr.Somasundaram, S., (2012). *Practical Physics*. Apsara Publications.

Reference Books

1. Dunlap, R.A., (1988). *Experimental Physics: Modern Methods*. Oxford University Press, New Delhi.
2. Jones, B.K., (1986). *Electronics for Experimentation and Research*. Prentice-Hall.
3. Zbar, P.B., Malvino, A.P., & Miller, M.A., (1994). *Basic Electronics: A Text-Lab Manual*. Tata Mc-Graw Hill, New Delhi.

Web References

1. https://www.msuniv.ac.in/Download/Pdf/b2efcbdbc4be452
2. https://www.studocu.com/in/document/reva-institute-of-technology-and-management/bachelors/msc-electronics-lab-student-copy/17586392
3. https://www.vlab.co.in/broad-area-physical-sciences

Pedagogy

Demonstration, practical sessions and viva voce

Course Designer

Dr.S.Gowri

SEMESTER-I	INTERNAL MARKS: 25		EXTERNAL MARKS: 75	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS / WEEK**	**CREDITS**
22PPH1DSE1A	**MICROPROCESSOR AND MICROCONTROLLER**	**DSE-I**	**6**	**3**

Course Objectives

- To understand the architecture of 8085 & 8051
- To impart the knowledge about the instruction set
- To understand the interfacing circuits for various applications of 8051 microcontroller.
- To introduce the architecture of advanced microprocessors and microcontroller.
- To analyse the basic concepts and programming of 8051 microcontroller

Pre-requisites

- Knowledge about Digital circuits
- Understanding of Programming languages

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the Course,students will be able to	Cognitive Level
CO 1	Understand the Basics of Microprocessor and impart the knowledge about the instruction set	K1,K2
CO 2	Demonstrate programming proficiency using the various addressing modes and data transfer instructions of microprocessor/Micro controller	K3
CO 3	Explain the data transfer schemes and interfacing devices	K4
CO 4	Distinguish the instruction set of microprocessor and micro controller and Create program with Micro controller	K5
CO 5	Develop programming skill using interfacing and Peripheral devices of Microprocessor	K6

Mapping of CO with PO and PSO

Cos	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	1	1	3	1	1	1	3	2	2
CO 2	2	2	1	3	1	3	3	2	2	3
CO 3	1	1	2	3	1	2	3	1	2	2
CO 4	1	1	2	3	1	3	3	3	2	3
CO 5	2	2	1	3	1	3	3	3	2	3

"1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation
"3" – Substantial (High) Correlation "-" indicates there is no correlation.

Syllabus

UNIT	CONTENT	HOURS	COs	CONGNITIVE LEVEL
I	**ARCHITECTURE OF 8085:** Architecture of 8085 - Data and Address buses - Registers in 8085- Addressing modes in 8085- Pin configuration of 8085 - Instruction set of 8085-Instruction types (based on number of bytes, operation) data transfer - Arithmetic - Logical- Branching- Stack and I/O instructions - Instruction cycles - Fetch operation - Execute operation - Machine cycle and State - Instruction and data flow - Timing diagram - Memory read and memory write cycles.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**MICROPROCESSOR PROGRAMING :** Assembly language - Stacks - Subroutines - MACRO - Delay Subroutine - Examples of Assembly language Programming - Addition-Subtraction – Shift an 8-bit number left by one bit-Mask off Least Significant 4Bits of an 8-bit number-Find the largest and Smallest number in a data array - Sumof a series - Multiplication - Division -Multi-byte addition and subtraction.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**DATA TRANSFER SCHEMESAND INTERFACING AND PERIPHERAL DEVICES:** Programmed data transfer scheme-Synchronous and Asynchronous and serial data transfer schemes-Interfacing devices- Types of interfacing devices-Programmable Peripheral Interface (PPI- 8255)-Communication interfacing device (Universal Synchronous Asynchronous Receiver Transmitter (USART- 8251))- Programmable DMA controller (8257).	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**MICROCONTROLLER-8051:** Introduction to micro controller- Difference between microprocessor and microcontroller. 8051 microcontroller: Pin configuration- Architecture and Key features 8051-Data types and directives Instruction set: Data transfer instructions - Arithmetic instructions – Logical instructions- Branching instructions- Addressing modes - Simple programs – Addition and subtraction of two 8-bit numbers – Multiplication-Division-Largest Number in an array -Sum of a set of numbers.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	**MICROPROCESSOR APPLICATIONS:** Microprocessor Interfacing and Applications: Programmable peripheral interface Intel 8255-Interfacing 7 segment LED display-Measurement of temperature-Microprocessor based traffic control-To generate square wave or pulse using Microprocessor.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

VI	**SELF STUDY FOR ENRICHMENT (Not included for End Semester Examination)** Assembly language Programs using Microprocessor - Decimal to Hexadecimal Conversion - Ascending and Descending order- Shift an 8-bit number left by 2 bit - Shift a 16-bit number left by one bit - Shift a 16-bit number left by 2 bit - Mask off Most Significant 4Bits of an 8-bit number.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Ram B. (2013). *Fundamental of Microprocessor and Microcontroller*.Dhanpat Rai Publications(P) Ltd, New Delhi.8 thEdition
2. GodseA.P ,Godse D.A. (2017).*Microprocessorsandmicrocontrollers*.Technical Publications,Pune.4 th Revised Edition

Reference Books

1. Muhammad AliMazidi, JiniceGillispieMazidi.(2004) *The 8051 microcontroller and embedded systems.* Pearson Education, Delhi.2nd Edition.
2. A.Nagoorkani.(2012*) Microprocessors & Microcontrollers*. RBA Publications, Chennai.2nd Edition.

Web References

1. http://nptel.ac.in/noc20_ee42
2. http://classcentral.com/course/swayam-micropocessor-an-interfacing-17694**.**

Pedagogy

Chalk and Talk, Seminar, Assignment, Power point Presentation, Group discussion and Quiz

Course Designer

Dr.T.Noorunnisha

SEMESTER-I	INTERNAL MARKS: 25		EXTERNAL MARKS: 75	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS / WEEK**	**CREDIT**
22PPH1DSE1B	**NON - DESTRUCTIVE EVALUATION TECHNIQUES**	**DSE-I**	**6**	**3**

Course Objectives

- To impart the knowledge in various Non-destructive testing (NDT) techniques.
- To overview the concepts and methods employed for NDT of Structures and materials.
- To understand the concept of Ultrasonic testing.
- To understand the limitations of NDT techniques.
- To introduce the concept of Real time Radiography Techniques.

Pre-requisites

- Knowledge about Acoustics
- Understanding of Ultrasonics
- Basic ideas about X- Rays

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course ,students will be able to	Cognitive Level
CO 1	Understand the basic working principles of various NDT methods and importance of NDT.	K1,K2
CO 2	Identify and Demonstrate the limitations of NDT techniques and codes.	K2,K3
CO 3	Analyze and Interpret Non-destructive testing and Mechanical testing.	K4,K5
CO 4	Examine the Real time Radiography Techniques.	K4
CO 5	Test the instrumentation techniques with the aid of basic Principles.	K5

Mapping of CO with PO and PSO

Cos	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	1	1	1	1	3	3	3	2	2
CO 2	2	1	1	1	2	3	3	2	2	1
CO 3	1	1	1	1	1	3	3	3	2	2
CO 4	1	1	1	1	1	3	3	1	2	1
CO 5	1	2	1	1	2	3	1	3	1	2

"1" – Slight (Low) Correlation
"2" – Moderate (Medium) Correlation
"3" – Substantial (High) Correlation
"-" indicates there is no correlation.

Syllabus

UNIT	CONTENT	HOURS	COs	CONGNITIVE LEVEL
I	**Overview of NDT:** NDT Versus Mechanical testing - Overview of the Non-Destructive Testing Methods for the detection of manufacturing defects- Merits and limitations -Visual inspection - Unaided and aided - Visual Examination- Optical aids used for visual inspection-Applications.	18	CO1, CO2, CO3, CO4, CO5,	K1, K2, K3, K4, K5, K6
II	**Surface NDE Methods:** Liquid Penetrant Testing- Basic principles – Procedure for penetrant testing - Penetrant testing materials - Testing methods - Applications and limitations - Magnetic Particle Testing Principle- Magnetizing techniques- Procedure-Equipment used for MPT- Limitations-Eddy Current Testing principles- Applications –Limitations.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**Radiography:** Radiography Basic principle -X ray source - production of X rays – High energy X ray source- Properties of X rays and gamma rays- radiographic imaging -Inspection techniques - Applications - Limitations - Safety in radiography.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**Ultrasonic Testing:** Ultrasonic Testing - Ultrasonic transducers-Inspection methods- Techniques for normal beam inspection - Techniques for angle beam inspection - Flaw characterization techniques - detection equipment - Modes of display- Immersion testing- Applications - Advantages-Limitations.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	**Acoustic Emission:** Testing Principles of Acoustic Emission Testing - Techniques- Applications - Thermography: Contact and non-contact inspection methods – Heat sensitive paints and other coatings – Heat sensitive papers – Advantages and limitations – Instrumentations and methods – Applications.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	**Self Study for Enrichment (Not included for End Semester Examination)** Basic properties of sound - Difference between Testing and Non Destructive Testing -Different types of Non Destructive Testing methods- Liquid Penetrant Testing and its application - Radio activity testing in Industries- Fundamentals of X-Rays.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Dr.BaldevRaj, T.Jayakumar and M.Thavasimuthu.,(2018).*Practical Non- Destructive Testing*., Narosa Publications, New Delhi.3 rd Edition
2. Ravi Prakash.(2010). *Non-Destructive Testing Techniques.*, New AgeInternational Publishers.1 st Revised Edition

Reference Books

1. BarryHull&Vernun John.,(1988).Non Destructive Testing.Springer.
2. Hull B., (2012). Non-destructive Testing., Springer Verlag., Springer Verlag.1 st Edition
3. Charles,J. Hellier.,(2013). Handbook of Nondestructive evaluation.,Mc Graw Hill, New York.2 nd Edition.
4. Aquil Ahmad Leonard J. Bond.,(1989) Non Destructive Examination and Quality Control, Metals Handbook.,American Metals Society,Metals Park,OH.Vol.17 9th Edition.

Pedagogy

Chalk and Talk, Seminar, Assignment, Power Point Presentation, Group discussion and Quiz

Course Designer

Dr.T.Noorunnisha

SEMESTER-I	INTERNAL MARKS: 25		EXTERNAL MARKS: 75	
COURSE CODE	COURSE TITLE	CATEGORY	HRS / WEEK	CREDITS
22PPH1DSE1C	ASTROPHYSICS	DSE-I	6	3

Course Objectives

- To study the positional astronomy such as measurement of distances, and angular positions of celestial objects
- To identify the physical principles involved in stellar processes
- To study the types of galaxies, dynamics of stars in a galaxy and its implication for dark matter.
- To understand the physics of the formation of white dwarfs and neutron stars
- To study the expansion of the universe and evolution of temperature in the Universe

Pre-requisites

- A thorough knowledge in Mechanics and Relativity
- Basic Knowledge in Calculus
- A basic insight in Electromagnetism

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO 1	Recall & interpret the basic concepts of Astrophysics	K1,K2
CO 2	Relate and identify the principles of physics in the study of astronomical objects	K2,K3
CO 3	Analyse the celestial objects in the universe	K4
CO 4	Classify and explain the stars, galaxies and stellar evolution	K4,K5
CO 5	Discuss the knowledge of the physical universe and its evolution	K6

Mapping of CO with PO and PSO

Cos	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO 1	PO 2	PO 3	PO 4	PO 5
CO1	3	3	3	1	3	3	3	3	2	3
CO2	3	2	3	1	3	3	3	3	2	3
CO3	3	3	3	1	3	3	2	2	1	2
CO4	3	3	3	1	3	3	3	2	1	2
CO5	3	3	3	1	3	2	3	2	1	2

"1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation
3" – Substantial (High) Correlation "-" – Indicates there is no correlation.

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**Distance measurements** Historical measurement of the Radius of the Earth Distance to Moon and Sun –Parallax method to measure the distance to nearby stars – Distance to inner planets – Cepheid Variables and distance to nearby Galaxies. Angular coordinates to describe angular positions on the Celestial Sphere – RA and Declination	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**Stellar structure** Virial Theorem –application of virial theorem to stellar systems – Formation of stars – Hertzsprung Russell Diagram – main sequence – Mass – Luminosity – Temperature relations of stars in Main Sequence – Post main sequence evolution of stars	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**Compact Objects** Formation of White dwarf and neutron stars – Mass estimation of relativistic and non-relativistic white dwarf – Chandrasekhar Mass limit – Mass of Neutron stars – Binary stars in a co rotating frame –Lagrange points – Qualitative aspects of mass transfer and accretion disk formation.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**Galaxies** Types of Galaxies – Hubble's tuning fork diagram – dynamics of stars in galaxies – rotation curve in spiral galaxies – velocity distribution of stars in Elliptical Galaxies– Problems on density profile calculation using different rotation curves.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	**Basic Cosmology** Newtonian derivation for the expansion of the Universe – Hubble's law –Radiation and matter in Cosmology – evolution of radiation Temperature in the Universe – Basics of Cosmic Microwave Background Radiation	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	**Self-Study for Enrichment** **(Not included for End Semester Examinations)** Concept of Zenith – Nadir– Star clusters- types of binaries – the Discovery of Dark Matter– the importance of 21 cm radiation.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Book

1. Frank H. Shu. (1982). *The physical universe –An introduction to astronomy*. University Science books.1st Edition.

2. V. B. Bhatia. (2001). *A Textbook of Astronomy and Astrophysics with Elements of Cosmology*. Narosa Publishing House. Revised Edition.

3. K.D.Abhyankar. (1999). *Astrophysics: Stars and Galaxies.* Universities Press.1st Edition.

Reference Books

1. S.L. Shapiro, S. A. Teukolsky.(1983). *Black holes, white dwarfs and neutron stars.* John Wiley.1st Edition.

2. S.Chandrasekhar.(2003).*An introduction to the study of stellar structure*. Dover publications.1st Edition.

Web References

1. https://www.coursera.org/courses?query=astrophysics
2. https://onlinecourses.swayam2.ac.in/arp19_ap73/preview

Pedagogy

Chalk and Talk, Seminar, Assignment, Power point Presentation

Course Designers

1. Ms. J. Aarthi
2. Dr. B. Anitha

SEMESTER -II	INTERNAL MARKS: 25		EXTERNAL MARKS: 75	
COURSE CODE	COURSE TITLE	CATEGORY	HRS / WEEK	CREDITS
22PPH2CC4	ELECTROMAGNETIC THEORY	CC-IV	6	5

Course Objectives

- To learn the theory for the field produced by stationary and moving charges.
- To study the charged systems and propagation of electromagnetic fields.
- To learn the basics of electromagnetic theory in electromagnetic waves
- To get knowledge about different geometrics of wave guides

Pre-requisites

- Strong foundation of basic Laws of Electromagnetic theory
- Commendable Knowledge of Electrostatic and Magnetostatic Boundary conditions
- Grasping Power in the concepts Field equations, conservation laws and Gauge transformations

Course Outcomes

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO 1	Remember and Understand the fundamentals of Electrostatics, Magneto statics and Electromagnetic waves.	K1,K2
CO 2	Analyze the concept of Electrodynamic fields and electromagnetic theory in Electrostatics	K3
CO 3	Evaluate the magnetic and electric field using various laws of magnetostatics and electrostatics.	K4
CO 4	Apply the transverse behavior of electromagnetic field equations for different propagating media and boundary value problems in electro-magneto statics	K5
CO 5	Create ability to evaluate electromagnetic wave equations and to solve problems in electro-magneto statics	K6

Mapping of CO with PO and PSO

COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	3	2	2	3	3	2	2	2
CO 2	3	3	2	2	2	3	1	2	2	1
CO 3	2	3	3	2	2	3	3	1	2	2
CO 4	3	3	2	2	2	1	2	2	2	2
CO 5	3	2	2	2	1	3	3	2	3	1

"1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation,

"3" – Substantial (High) Correlation "-" indicates there is no correlation.

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**ELECTROSTATICS** Coulomb's law – The electric field – Continuous charge distributions- Field lines, Flux and Gauss's law and its application - Field due to an infinite, straight, uniformly charged wire – Multipole expansion of a charge distribution- The Divergence of E – The curl of E – Electric potential - Poisson's and Laplace Equation - Potential of a localized charge distribution –Uniqueness theorems.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**BOUNDARY VALUE PROBLEMS IN ELECTROSTATICS** Boundary conditions – Potential at a point between the plates of a spherical capacitor –Potential at a point due to uniformly charged disc – Method of image charges –Point charge in the presence of a grounded conducting sphere-Point charge in the presence of a charged, insulated conducting sphere -Conducting sphere in a uniform electric field –Laplace equation in rectangular coordinates.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**MAGNETOSTATICS** The Lorentz Force Law – The Biot- Savart Law – The magnetic field of steady current - The Divergence and Curl of B – Applications of Ampere's Law – Magnetic scalar and vector potentials– Magnetic dipole in a uniform field– Magnetization current- Magnetic intensity–Magnetic susceptibility and permeability	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**FIELD EQUATIONS AND CONSERVATION LAWS** Ohm's law -Faraday's law – induced electric field - Inductance – Energy in magnetic fields – Maxwell's equations in free space and linear isotropic media - Boundary conditions on fields at interface-continuity equations – Poynting's theorem - Potential formulation – Lorentz and Coulomb Gauge transformations – retarded potentials.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	**ELECTROMAGNETIC WAVES AND WAVE PROPAGATION** Electromagnetic waves in frees pace –Propagation of electromagnetic waves in isotropic dielectrics and in anisotropic dielectrics–Reflection and refraction of electromagnetic waves: Kinematic and dynamic properties – TM and TE modes–Propagation in rectangular waveguides– Cavityresonator.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	**SELF STUDY FOR ENRICHMENT:** **(Not to be included for External Examination)** Electrostatic Boundary conditions-boundary value problems on spherical symmetry-Method of images -Magnetic potential from uniform surface current - of a long solenoid-Potential formulation-Energy and momentum in EM waves	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Jackson.J.D. (1999), *Classical Electrodynamics*, 3rd edition John-Wiley, New York
2. Chopra.K.K and. Agarwal.G.C, (1999), *Electromagnetic Theory* 3rdedition K.Nath & Co.,Meerut
3. Jordan . E.C. and K.G.Balmain,(2015), *Electromagnetic Waves and Radiating Systems*, 3rd edition New Delhi.

Reference Books

1. Griffiths. D.J.(2014) Introduction *to Electrodynamics* 4th edition. Pearson, Essex.
2. Chow. T.L.(2012)*Electromagnetic Theory* 4th edition. Jones and Bartlett Learning.

Web References

1. https://bbsbec.edu.in/wp-content/uploads/2020/01/Question-Bank2.pdf
2. https://studentsfocus.com/ee8391-et-question-papers-electromagnetic-theory-previous-year-question-papers- eee-3rd-sem/
3. https://learnengineering.in/ee8391-electromagnetic-theory/

Pedagogy

Chalk and Talk, Lecture, Seminar, Assignment and Power Point Presentation

Course Designer

Dr.K.KANNAGI

SEMESTER -II	INTERNAL MARKS : 25	EXTERNAL MARKS : 75		
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
22PPH2CC5	**QUANTUM MECHANICS – II**	**CC-V**	**6**	**5**

Course Objectives

- To demonstrate the use of Schrodinger wave equation through some simple one-dimensional problems and their solutions.
- To familiarize the students to the new mathematical tools such as operators and linear vector space required for venturing into the realm of quantum mechanics and to introduce Schrodinger wave equation.
- To analytically and algebraically treat the orbital angular momentum problem, to bring out its quantum nature and to port it to have a theory of spin angular momentum.
- To generalize the one-dimensional problems to three dimensional ones to broaden the horizon of the students leading to the understanding of the concept of degeneracy.
- To solve hydrogen atom problem to explain atomic spectrum.

Pre - requisites

- A thorough understanding of mechanics.
- Knowledge of partial differential equation and variable separable method.
- Commendable knowledge of integral and differential calculus.

Course Outcomes and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the Course, the Student will be able to	Cognitive Level
CO 1	Remember and Understand the perturbation theory to formulate problems for proper understanding of Physics	K1,K2
CO 2	Analyze the advanced techniques in Physics to gain insights towards quantum mechanics	K3
CO 3	Evaluate and ascertain the mathematical concepts behind fundamentals of quantum mechanics.	K4
CO 4	Apply the development of mathematical skills and problem solving in perturbation theory	K5
CO 5	Create the critical thinking over the relativistic quantum physics	K6

Mapping of CO with PO and PSO

COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	3	2	3	3	3	2	2	3
CO 2	3	2	2	2	2	2	1	2	3	2
CO 3	2	3	3	2	3	3	3	1	2	3
CO 4	2	3	2	2	2	1	2	2	2	2
CO 5	3	2	2	2	1	3	3	2	3	2

"1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation

"3" – Substantial (High) Correlation "-" indicates there is no correlation.

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**TIME-INDEPENDENT PERTURBATION THEORY I** Perturbation theory for discrete levels: Equation in various orders-Non-degenerate levels - degenerate levels: Removal of Degeneracy - Stark effect: Ground state of Hydrogen atom - First excited state of Hydrogen atom – Spin orbit interaction - Two electron atoms	**17**	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**TIME-INDEPENDENT PERTURBATION THEORY II** Variational method: Upper bound on ground state energy - Application to excited states -Ground state of a two electron atom - Hydrogen molecule - Exchange Interaction - WKB approximation: One dimensional Schrödinger equation with asymptotic solution-Solution near a turning point-Bohr-Sommerfeld Quantum Condition - WKB solution of the radial wave equation	**17**	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**TIME-DEPENDENT PERTURBATION THEORY** Perturbative solution for transition amplitude - Selection rule - First order and second transitions: Constant perturbation - Fermi's golden rule - Scattering of a particle by a potential - Inelastic Scattering: Exchange Effects - Harmonic perturbations: Amplitude for transition with change of energy - Transition induced by incoherent spectrum of perturbing frequencies - The Dipole Approximation: Selection Rules- The Einstein Coefficients: Spontaneous Emission	**17**	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**SCATTERING THEORY** The Born approximation - Validity of Born approximation - Born Series- Eikonal approximation- Partial wave analysis: Asymptotic behaviour of partial waves - Scattering amplitude in terms of phase shifts - Optical theorem - Exactly Soluble Problems :Scattering by a square well potential- Scattering by coluomb potential -Scattering by a hard sphere-Mutual Scattering Of Two Particles: Reduction of the Two - Body Problem- Transformation from Centre of Mass to Laboratory Frame of Reference-Collisions between Identical Particles.	**22**	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

V	**RELATIVISTIC QUANTUM MECHANICS** Generalization of the Schrodinger equation-Hydrogen like atom- The Klein - Gordan equation: Plane Wave Solutions; Charge and Current Densities –Non relativistic Limit - Dirac Equation: Dirac's Relativistic Hamiltonian-Position Probability Density; Expectation Values - Dirac's matrices -Plane Wave Solutions of the Dirac Equation - Spin of the Dirac particle .	**17**	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V1	**SELF STUDY FOR ENRICHMENT:** **(Not to be included for External Examination)** Differential and total cross section-Scattering amplitude - Scattering amplitude in terms of Green's functions- Significance of Negative Energy State - Spin Orbit Energy	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Mathews.P. M. and Venkatesan K, (1987), *A Text Book of Quantum Mechanics*, Second edition Tata
2. McGraw Hill, New Delhi.
3. Aruldhas G, (2009), *Quantum Mechanics*, Second edition , Prentice Hall of India. Ghatak A & Lokanathan S, (1987), *A Text Book of Quantum Mechanics*, Tata McGraw Hill, New
4. Delhi
5. Eugen Merzbacher, (1998), *Quantum Mechanics*, Third edition, John Wiley & Son, Inc, Newyork

Reference Books

1. Devanathan V, (2006), *Quantum Mechanics*, Narosa Publishing House, New Delhi,
2. Schiff L , (2014), *Quantum Mechanics*, 4th edition, Tata McGraw Hill, New Delhi,
3. Shankar R, (2007), *Principles of Quantum Mechanics*, 2nd edition, Springer, New Delhi.
4. Thankappan V.K, *Quantum Mechanics*, 2nd Edition Wiley Eastern Ltd, New Delhi.

WebReferences

1. https://www.britannica.com/science/quantum-mechanics-physics
2. https://plato.stanford.edu/entries/qm/
3. https://www.newscientist.com/definition/quantum-mechanics/

Pedagogy

Chalk and talk , Lecture, Seminar, Assignment and Power Point Presentation

Course Designer

Dr.R.MEENAKSHI

SEMESTER -II	INTERNAL MARKS: 25		EXTERNAL MARKS: 75	
COURSE CODE	COURSE TITLE	CATEGORY	HRS / WEEK	CREDITS
22PPH2CCC1A	ELECTRONICS	CCC- I	6	4

Course Objective

- To Provide the working of advanced semiconductor devices and digital circuits
- To Understand the utility of OP-AMP
- To learn the basics of integrated circuit fabrication, applications of timer IC-555
- To get knowledge about building block of digital systems.
- To enhance problem solving skills and to promote the ability to apply digital circuits

Pre-requisites

- A Thorough Knowledge of Semiconducting Devices
- Strong Insight in IC Fabrication Technique
- Grasping Power in the concepts OP-AMP

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO 1	Remember and Understand the concepts of semiconductor devices	K1,K2
CO 2	Analyze the working function of Semiconductor and ICs	K3
CO 3	Evaluate the basic concepts of Sensor ,Transducers, operational amplifier , oscillator circuits and IC	K4
CO 4	Apply the Principles and Concepts of Sensor ,Transducers and Semiconductor devices in digital and analog circuits.	K5
CO 5	Recommend projects in electronics relevant to industrial and R &D needs	K6

Mapping of CO with PO and PSO

Cos	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	3	2	1	3	3	2	2	2
CO 2	3	3	2	2	2	3	1	2	2	2
CO 3	2	3	3	2	2	3	3	1	2	2
CO 4	3	3	2	2	2	1	2	2	2	2
CO 5	3	2	2	2	1	3	3	2	3	1

"1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation,

"3" – Substantial (High) Correlation "-" indicates there is no correlation.

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**SPECIAL DEVICES, SENSORS AND TRANSDUCER** Device construction and characteristics of Schottky Diode, Step Recovery Diode, MOSFET, UJT, SCR - Optoelectronic devices: Light Emitting Diode (LED), LASER Diode, Photo Multiplier Tube – Sensors: Photoconductive Cell, Photo Voltaic Cell - Transducers: Electromagnetic Flow meter, Linear Variable Differential Transformer (LVDT), Strain Gauge, Resistance Temperature Detectors.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**OPERATIONAL AMPLIFIER** Characteristics of an Op – amp -inverting and non-inverting amplifier–adder, subtractor, differentiator–integrator– Active filters: low pass – high pass filters – voltage comparator – Wave form generators: Phase shift and Wein's Bridge Oscillator - Schmitt trigger– Design of Binary weighted and R- 2R ladder method - D/A converter – A/D converter, Counter Method, Solving Simultaneous equation.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**IC FABRICATION AND IC 555 TIMER** Basic monolithic ICs – epitaxial growth, masking, and etching – Diffusion of impurities – monolithic transistors – integrated diodes – resistors and inductors –monolithic circuit layout – metal semiconductor contact. IC 555 Timer – Functional diagram of 555 timer – Astable multivibrator – Monostable multivibrator – Voltage Controlled Oscillator (VCO).	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**COMBINATIONAL AND ARITHMETIC LOGIC CIRCUIT** Combinational logic circuit design – Karnaugh map method – Quine Mc Cluskey's tabular method– decoders: 1 of 16 Decoder –BCD to seven segments decoder - totalizing counter- Encoder: 8input priority encoder - 16 line to 1 line multiplexer – Demultiplexer: 1to 16 Demultiplexer controlled inverter - half adder/ subtractor – Arithmetic logic unit – 2's complement, adder, subtractor, one digit BCD adder and subtractor using IC7483- Serial and parallel adder units.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	**SYNCHRONOUS COUNTERS AND MEMORY DEVICES** Universal synchronous counter stage–counter functions–module N counter using IC74193–design of synchronous counters– ring counter –Johnson counter – Memoryclassification –ROM –Memoryorganization -PROM- EPROM- RAM- Block Diagram of Static RAM-Serial and Parallel Expansion of RAM – memory–DRAM- Basic DRAM memory cell-Magnetic disk memory: Charge Coupled device-Magnetic bubble memory.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

VI	**SELF STUDY FOR ENRICHMENT:** (Not to be included for External Examination) Gunn Diode- IMPATT Diode-Successive Approximation method-Fabrication Process-Concepts of combinational Logic circuit-PAL and PLA	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Virendra Kumar (2003) *Digital Technology Principles* and Practice New Age International Prentice Hall New Jersey.
2. Albert Paul , Melvino (1982) *Electronic Principles* Tata MC Graw– HillpublishingcompanyLimited, New Delhi.
3. Malcolm Goodge, (2010) *Semiconductor device Technology*, TATA McGraw Hill publications, New Delhi.
4. Millmanand Halkias(1983), *Integrated Electronics*, TATA McGraw Hill publications, New Delh,.
5. AllenMottershed, (1982)*Semiconductor devices and applications*, New Age International publishers.

Reference Books

1. Chattopadhyay. D and Rakshit P.C, (2010),*Electronics Fundamentals and Applications*, New age international Publications, New Delhi.
2. Gayakwad *R*.A, (1999) *Op. amps & linear integrated circuits*, Prentice HallIndiaPvt.Ltd.
3. Salivahanan S, Suresh Kumar N,(2011)*Electronic devices and Circuits*, Tata McGraw Hill.
4. L.Floyd, *Electronic Devices*, (2006) Pearson Education New York.
5. Theraja B.L, (2012) *Basic electronics*, S.Chand.

Web References

1. http://www.analog.com/en/education/education-library/tutorials/ analog- electronics.html
2. https://www.tutorialspoint.com/digital_electronics/index.asp

Pedagogy

Chalk and Talk, Seminar, Assignment, Power point Presentation, Group discussion and Quiz

Course Designer

Dr.K.KANNAGI

SEMESTER-II	INTERNAL MARKS: 25	EXTERNAL MARKS: 75		
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
22PPH2CCC1B	NONLINEAR DYNAMICS	CCC-I	6	4

Course Objectives

- To provide an introduction to discrete and continuous nonlinear dynamical systems
- To analyze an advanced level learning of Nonlinear Dynamics, Chaos and applications.
- To understand the concepts of integrable dynamical systems and solitons.
- To understand the concepts on the linear stability analysis

Pre-requisites

- Basic understanding of non-linear differential equations.
- Concepts of solitons.
- Understanding the basic needs of controlling chaos.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the Course, the Student will be able to	Cognitive Level
CO 1	Understanding the concepts on the linear stability analysis	K2
CO 2	Explain the basic bifurcations with suitable examples.	K2
CO 3	Illustrate the various characterizing tools such as power spectrum and Lyapunov exponents.	K3
CO 4	Identify numerical experiment of Fermi, Pasta and Ulam and its outcome.	K4
CO 5	Analyze linear and nonlinear systems and appreciate the concept of nonlinearity	K5,K6

Mapping of CO with PO and PSO

COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	3	3	3	3	3	3	2	2	3
CO 2	2	3	3	3	3	3	3	2	2	3
CO 3	2	3	3	3	3	3	3	2	3	3
CO 4	2	3	3	2	3	3	2	2	2	3
CO 5	2	3	3	2	3	3	2	2	2	3

"1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation

"3" – Substantial (High) Correlation "-" indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**NON-LINEAR DYNAMICS** Dynamical systems–linear and nonlinear forces–mathematical implications of nonlinearity–working definitions and effects of nonlinearity –damped and driven nonlinear oscillators– autonomous and non-autonomous systems – dynamical systems as coupled first – order differential equations: equilibrium points – phase space/phase plane and phase trajectories – stability – attractors and repellers – classification of equilibrium – points – limit cycle motion – periodic attractor.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**BIFURCATIONS AND CHAOS** Bifurcation theory–Local and global bifurcations - Three dimensional autonomous systems and chaos, Lyapunov exponents –Torus–quasi-periodic attractor – Poincaré map – Period doubling cascades–Feigenbaum number–characterization–Homoclinic orbits, heteroclinic orbits–Strange attractor and strange non-chaotic attractor.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**DISCRETE DYNAMICS SYSTEMS, SYNCHRONIZATION AND CONTROLLING OF CHAOS** Linear and nonlinear discrete dynamics systems – complex iterated maps–Logistic map–Linear stability–Period doubling phenomena and chaos–Lyapunov exponents–Chaos synchronization– Synchronization manifold and stability properties – Controlling of Chaos –applications.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**FRACTALS, CELLULAR AUTOMATA AND PATTERN FORMATION** Dimension of regular and chaotic attractors – Fractals – Koch curve Cantor set – Sierpinskiset–Julia and Mandelbrot sets–Cellular automata–Self organized criticality–Stochastic resonance–pattern formation–Time series analysis	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	**INTEGRABLE SYSTEMS AND SOLITONS** Finite dimensional integrable systems - Linear and nonlinear dispersive systems – Cnoidal and solitary waves - The Scott Russel phenomenon and derivation of Korteweg- de Vries (KdV)equation–Fermi–Pasta–Ulam(FPU) numerical problem–FPU recurrence phenomenon – Numerical experiments of Zabusky and Kruskal – Explicit soliton solutions :one- ,two- and N-soliton solutions of KdVequation– Hirota's bilinear method.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	**SELF STUDY FOR ENRICHMENT** **(Not to be included for External Examination)** Simple bifurcations- Chaos-Dynamics systems-Exercise and Problems.		CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Lakshmanan M & Rajasekar S., (2003*). Nonlinear Dynamics: Integrability, Chaos & Pattern*, New Delhi: Springer (India) Pvt. ltd. Print.
2. Wolfram. S. (2002), *A New Kind of Science*, Wolfram Media Inc.,
3. Schuster H.G., (2005), *Deterministic Chaos : An Introduction*, Wiley-VCH

Reference Books

1. Lakshmanan M, and Murali K, (1996), *Choas in Nonlinear Oscillators*, World Scientific, Singapore.
2. Fuchs A, (2013) *Nonlinear Dynamics in Complex Systems: Theory and Applications for the Life, Neuro- and Natural Sciences*, Springer.
3. Strogatz, S.H. (2014), *Nonlinear Dynamics and Chaos: With Applications to Physics, Biology, Chemistry, and Engineering*, 2nd Edition CRC Press.
4. Misbah. C,(2017) *Complex Dynamics and Morphogenesis: An Introduction to Nonlinear Science*, Springer.
5. Robert C. Hilborn. (2004). *Chaos and Nonlinear Dynamics*, 2nd Edition, India: Oxford University press. Print.

Web References

1. https://onlinecourses.nptel.ac.in/noc19_cy33/preview
2. https://www.youtube.com/watch?v=A9x2hmSmVjs

Pedagogy

Chalk and Talk, Power Point Presentation, Seminar, Quiz, Assignment and Group discussion.

Course Designer

Dr. R. MEKALA

SEMESTER -II	INTERNAL MARKS: 25		EXTERNAL MARKS: 75	
COURSE CODE	COURSE TITLE	CATEGORY	HRS / WEEK	CREDITS
22PPH2CCC1C	SPECTROSCOPY	CCC - I	6	4

Course Objectives

- To understand the vibrational and rotational spectroscopic principles.
- To know the fundamentals of FTIR, NMR techniques.
- To use spectroscopic instruments like FTIR for analyzing the samples.
- To understand the theory of electronic spectroscopy and ESR instrumentation.
- To procure knowledge on advanced level spectroscopic techniques.

Pre-requisites

- Fundamental knowledge on electromagnetic radiation.
- Basic ideas in molecular spectra.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO 1	Understand and explain the fundamental concepts and applications of microwave, IR, Raman and other spectroscopic methods.	K1,K2
CO 2	Make use of electronic spectroscopy for chemical analysis.	K3
CO 3	Analyze the NMR and FTIR spectra of various samples and identify their chemical structure.	K4
CO 4	Choose suitable spectroscopic technique and examine the chemical composition of a material.	K5
CO 5	Apply the knowledge acquired and use spectroscopic instruments to examine and develop new materials.	K6

Mapping of CO with PO and PSO

Cos	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	2	1	1	3	3	2	2	2	2
CO 2	3	2	1	1	3	3	3	2	2	3
CO 3	3	2	1	1	3	3	3	2	2	3
CO 4	3	2	1	1	3	3	3	3	2	3
CO 5	3	2	1	1	3	3	3	3	2	3

"1" – Slight (Low) Correlation; "2" – Moderate (Medium) Correlation;

"3" – Substantial (High) Correlation; "4" – Indicates there is no correlation.

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**MICROWAVE SPECTROSCOPY:** Rotation of molecules-Rotational spectra - Rigid and non-rigid diatomic rotator-Intensities of spectral lines- Effect of Isotopic substitution-Polyatomic molecules (Linear, symmetric top and asymmetric top)-Chemical analysis by microwave spectroscopy- Techniques and instrumentation- microwave oven.	16	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**INFRARED SPECTROSCOPY:** Vibration of Diatomic molecules-Simple Harmonic Oscillator-Anharmonic oscillator-Diatomic vibrating rotator- The vibration-rotation spectrum-Interactions of rotations and vibrations-The vibrations of polyatomic molecules-Influence of rotation on the Vibrational spectra of linear and symmetric top molecules-Analysis by infrared techniques-Instrumentation-FTIR spectroscopy.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**RAMAN SPECTROSCOPY:** Classical and quantum mechanical picture of Raman effect - Polarizability-Pure rotational Raman spectra- Vibrational Raman Spectra-Raman activity of vibrations of CO_2 and H_2O-Rule of mutual exclusion-Overtone and combination vibrations-Rotational fine structure -Vibrations of spherical top molecule-structure determination from Raman and IR spectroscopy-techniques and instrumentation-FT Raman spectroscopy - Surfaces for SERS study-SERS microbes Surface selection rules.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**ELECTRONIC SPECTROSCOPY:** Electronic spectra of diatomic molecule - Frank-Condon principle-Dissociation energy and dissociation products - Rotational fine structure- Fortrat diagram- Predissociation-Shapes of some molecular orbits- Chemical analysis by electronic spectroscopy-Techniques and instrumentation- ESR spectroscopy-Introduction- Techniques and instrumentation.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	**NUCLEAR SPECTROSCOPY:** Nuclear magnetic resonance spectroscopy-Introduction-Interaction of spin and magnetic field- population of energy levels-Larmor precession-Relaxation time-Double resonance-Chemical shift and its measurement- Coupling constant-Coupling between several nuclei- Quadrupole effects C^{13} NMR spectroscopy- Interpretation of simple spectrum - Mossbauer spectroscopy:Principle-instrumentation - Applications of Mossbauer spectroscopy: Chemical shift effect of electric and magnetic fields.	20	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

VI	**SELF-STUDY FOR ENRICHMENT:** **(Not to be included for External Examination)** Principle of atomic absorption spectra - Applications of atomic absorption spectra - Application of FTIR Spectroscopy - Introduction to UV spectroscopy - Types of transition in Organic molecules - Atomic emission Spectroscopy – Difference between atomic absorption spectra and atomic emission spectra.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Banwell C.N and Mc Cash E.M, (1994), *Fundamentals of Molecular Spectroscopy,* 4thEdition, Tata Mc Graw-Hill, New Delhi.
2. Aruldhas G, (2001), *Molecular structure and spectroscopy,* Prentice Hall of India Pvt. Ltd., New Delhi
3. Sindhu P.S, (1990), *Molecular Spectroscopy,* 1st Edition, Tata McGraw-Hill, New Delhi.
4. D.N.Sathyanarayana, (2004), *Vibrational Spectroscopy,*1st Edition, New age International Publishers, Tamilnadu.

Reference Books

1. King G.W, (1964), *Spectroscopy and molecular structure,* 1st Edition, Holt Rinehart and Winston Inc, London
2. Kaur H, (2009), *Spectroscopy,* 5th Edition, A Pragati Prakashan, Uttarpradesh, India.
3. Raymond Chang, (1980), *Basic Principles of Spectroscopy* Mc Graw-Hill, New York.
4. Engel T. (2015), *Quantum Chemistry and Spectroscopy*, 3rd Edition, Pearson, New York.
5. Carlson T. (2013), *Photoelectron and auger Spectroscopy*. Springer.

Web References

1. JLExp13.pdf (mit.edu)
2. https://nptel.ac.in/courses/115101003
3. B-2 Mossbauer Spectroscopy - Physics 191r (harvard.edu)

Pedagogy

Chalk and Talk, Seminar, Assignment, Power point Presentation, Group discussion and Quiz

Course Designer

Ms. D.DEVI

SEMESTER -II	INTERNAL MARKS: 25		EXTERNAL MARKS: 75	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS / WEEK**	**CREDITS**
22PPH2CC2P	**MICROPROCESSOR AND PYTHON PROGRAMMING(P)**	**CP-II**	**6**	**5**

Course Objective

- To understand the fundamental Formulation of Numerical Problems of various methods.
- To solve Numerical problems and their applications
- To develop the programming skills of Microprocessor and Python programming
- To Design the Numerical Programmes in Python Language.

Pre-requisites

- Basic ideas in doing experiments in Programmed and formula skills.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the Course, the student will be able to	Cognitive Level
CO 1	Understand the basic operations of 8085	K2
CO 2	Apply the knowledge about the code conversions of 8085	K3
CO 3	Analyze the skills in decimal counting of 8085	K4
CO 4	Evaluate the Numerical Problems using Python programming	K5
CO 5	Develop skills in Python Programming.	K6

Mapping of CO with PO and PSO

COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	3	3	2	2	3	2	1	1
CO 2	2	3	3	3	2	3	2	3	2	2
CO 3	3	3	2	3	3	2	3	3	2	1
CO 4	3	2	3	3	2	3	3	2	3	2
CO 5	3	2	2	2	2	3	3	2	1	1

"1" – Slight (Low) Correlation, "2" – Moderate (Medium) Correlation,

"3" – Substantial (High) Correlation, "-" indicates there is no correlation.

Syllabus

LIST OF EXPERIMENTS (ANY 15)

A. Microprocessor (8085)

1. Finding the largest and smallest numbers in a data array
2. Arranging a set of numbers in ascending and descending orders
3. Study of multibyte decimal addition
4. Study of multibyte decimal subtraction
5. Study of seven segment display
6. Study of ADC interfacing (ADC 0809)
7. Traffic control system
8. Digital clock
9. Generation of square and sine waves using DAC 0800

B. Python Programming

1. Least-squares curve fitting– Straight-line fit
2. Least-squares curve fitting– Exponential fit
3. Real roots of one-dimensional nonlinear equations-Newton Raphson method
4. Numerical integration – Composite trapezoidal rule
5. Numerical integration – Composite Simpson's 1/3 rule
6. Solution of a second-order ODE – Euler method
7. Solution of a first-order ODE – Fourth-order Runge-Kutta method
8. Solution of a second-order ODE – Fourth-order Runge-Kutta method

Text Books

1. Ouseph C.C, Rao U.J &Vijayendran V. (2009) , *Practical Physics and Electronics*, S.Viswanathan, Printers & Publishers Pvt Ltd
2. Dr. Somasundaram S,(2012) , *Practical Physics*, Apsara Publications
3. Jeeva Jose &P.Sojan Lal, (2016) *Introduction to Computing and Problem Solving with Python*, khanna Book Publishing Co.(P).Ltd,
4. Qingai Kong, Timmy Siauw & Alexandre Bayen,(2020) ,*Python Programming and Numerical Methods: A Guide For Engineers And Scientists*, Academic Press Inc.

Reference Books

1. Department of Physics, *Practical Physics, (M.sc)*, St.Joseph's College,
2. Mark Lutz, (2014), *Python Pocket Reference*, O'Reilly Media.

Web References

1. http://vlabs.iitb.ac.in/vlabs-dev/labs/8051-Microcontroller-Lab/labs/exp2/index.php
2. www.tutorialspoint.com
3. https://pythonnumericalmethods.berkeley.edu/notebooks/chapter21.03-Trapezoid-Rule.html

Pedagogy

Demonstration and Practical sessions and viva voce

Course Designer

Dr. S.GOWRI

SEMESTER -II	INTERNAL MARKS: 25		EXTERNAL MARKS: 75	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS / WEEK**	**CREDITS**
22PPH2DSE2A	**NUMERICAL METHODS AND PYTHON PROGRAMMING**	**DSE - II**	**6**	**3**

Course Objectives

- To understand the Basics Concepts and impart the knowledge about the Numerical problems and Python
- To analyse the basic concepts of Numerical Problems and Python
- To impart the knowledge about Finding the solution of Boundary value and Eigen value Problems.
- To understand the basic Formulation of Numerical Problems of various methods.
- To Design the Numerical Programmes in Python Language.

Pre-requisites

- Basic Knowledge about Python Language
- Understanding of Basic concepts of Integration, Differentiation and Interpolation

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO 1	Understand the Basics Concepts and impart the knowledge about the Numerical problems and Python	K1,K2
CO 2	Apply and Demonstrate programming proficiency of Numerical Problems using Python	K3,K4
CO 3	Explain to find the Solution of Boundary value problems and Eigen value problem, Interpolation, Differentiation and Integration	K4,K5
CO 4	Distinguish the various methods of finding the Solution of Boundary value problems and Eigen value problem, Interpolation, Differentiation and Integration	K5,K6
CO 5	Develop programming skill in Boundary value problems and Eigen value problem, Interpolation, Differentiation and Integration	K5,K6

Mapping of CO with PO and PSO

Cos	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	2	3	1	3	3	3	1	1	3
CO 2	3	2	3	1	3	3	3	1	1	3
CO 3	3	2	3	1	3	3	3	1	1	3
CO 4	3	2	3	1	3	3	3	1	1	3
CO 5	3	2	3	1	3	3	3	1	1	3

"1" – Slight (Low) Correlation , "2" – Moderate (Medium) Correlation ,

"3" – Substantial (High) Correlation, "-" indicates there is no correlation.

Syllabus

UNIT	CONTENT	HOURS	Cos	CONGNITIV ELEVEL
I	**SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS** Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method-Solution of linear system of equations – Gauss elimination method -Pivoting – Gauss Jordan method –Iterative methods of Gauss Jacobi and Gauss Seidel-Matrix Inversion by Gauss Jordan method – Eigen values of a matrix by Power method.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**INTERPOLATION AND APPROXIMATION** Interpolation with unequal intervals - Lagrange's interpolation – Newton's divided difference interpolation – Cubic Splines – Interpolation with equal intervals - Newton's forward and backward difference formulae.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**NUMERICAL DIFFERENTIATION AND INTEGRATION** Approximation of derivatives using interpolation polynomials- Numerical integration using Trapezoidal, Simpson's1/3 rule - Simpson's 3/8 rule -Taylor's series method–First order differential equation: Euler's method - Modified Euler's method – Improved Euler's method – Second Order Differential equation: Fourth order Runge - Kutta method and Euler's method.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**INTRODUCTION TO PYTHON** Operators – Data types and Operations- Numbers – Strings-List – Tuple – Set – Dictionary - Flow control – Decision Making – Loops – Nested Loops – Control Statement – Functions.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	**NUMERICAL ALGORITHMS IN PYTHON** Real roots of one-dimensional nonlinear equations - Newton Raphson method - Numerical integration – Composite trapezoidal rule - Numerical integration – Simpson's 1/3 rule - Simpson's 3/8 rule – Euler methods- Solution of a first-order ODE – Runge-Kutta method - Solution of a second-order ODE – Runge - Kutta method	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	**SELF STUDY FOR ENRICHMENT** **(Not included for End Semester Examination)** Least-squares curve fitting – Straight-line fit - Least-squares curve fitting – Exponential fit .	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Venkataraman M K, (1999), *Numerical Methods in Science and Engineering*, 5th Edition, The NationalPublishing Company, Madras.
2. Mathews J H, (1998), *Numerical Methods for Mathematics, Science and Engineering*, 2nd Edition, Prentice-Hallof India, New Delhi.
3. Jeeva Jose & Sojan Lal P, (2016), *Introduction to Computing and Problem Solving with Python*, khanna Book Publishing Co.(P).Ltd
4. Qingai Kong, Timmy Siauw, Alexandre Bayen, (2020), *Python Programming and Numerical Methods: A Guide For Engineers And Scientists*, Academic Press Inc.

Reference Books

1. Jain M.K, Iyengar S.R.K and Jain Muhammad R.K, (1993), *Numerical Methods for Scientific and Engineering Computation*, New Age International, New Delhi.
2. Mark Lutz (2014), *Python Pocket Reference*, O'Reilly Media.

Web References

1. https://www.youtube.com/watch?v=QqhSmdkqgjQ
2. https://www.vedantu.com/maths/numerical-analysis
3. https://www.math.hkust.edu.hk/~machas/numerical-methods.pdf

Pedagogy

Chalk and Talk, Seminar, Assignment, Power point Presentation, Group discussion and Quiz

Course Designer

Ms. S. PRIYA

SEMESTER - II	INTERNAL MARKS : 25	EXTERNAL MARKS : 75		
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
22PPH2DSE2B	**PHYSICS OF SENSOR AND TRANSDUCER**	**DSE - II**	**6**	**3**

Course Objectives

- To acquire Basic Knowledge Sensing and transducer devices.
- To develop critical thinking and problem-solving skills.
- To acquire critical thinking and problem solving skills.
- To acquire Basic Knowledge capacitive and inductive transducers.

Pre-requisites

- Knowledge of physical parameters
- Knowledge of Sensing devices and transducers

Course Outcome and Cognitive Level Mapping:

CO Number	CO statement On the successful completion of the course, students will be able to	Cognitive level
CO 1	Remember and Understand the Primary idea in Sensor and transducers in instrumentation.	K1,K2
CO 2	Analyze the different types of sensors and Transducers.	K3
CO 3	Evaluate the working function of sensor transducers for measurement of displacement, strain, velocity, acceleration etc.	K4
CO 4	Apply the function and view for the sensor, transducer construction, classification, principle of operation and characteristics in proper applications.	K5
CO 5	Create the Critical thinking in sensing and transducer devices.	K6

Mapping of CO with PO and PSO

COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	2	1	3	3	2	2	2	2
CO 2	3	3	2	1	3	3	2	2	2	2
CO 3	3	3	2	1	3	3	2	2	2	2
CO 4	3	3	2	1	3	3	2	2	2	2
CO 5	3	3	2	1	3	3	2	2	2	2

"1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation,

"3" – Substantial (High) Correlation "-" indicates there is no correlation.

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**SENSOR BASICS** Introduction-Mechanical-Electronic Transitions in Sensing-Nature of Sensors-Difference between sensor, transmitter and transducer-Primary measuring elements - Selection and characteristics: Range; resolution, Sensitivity, error, repeatability and linearity.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**SEMICONDUCTOR SENSOR** Introduction-Sensor Output Characteristics-Wheatstone Bridge- Piezo resistivity in Silicon-Semiconductor Sensor Definitions.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**SENSING TECHNOLOGIES** Capacitive Sensing- Piezoelectric Sensing- Hall Effect-Chemical Sensors- Improving Sensor Characteristics- Digital Output Sensors- Incremental Optical Encoders- Digital Techniques- Noise/Interference Aspects- Analysis of Sensitivity Improvement- Thin Diaphragm- Increased Diaphragm Area	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**INDUCTIVE & CAPACITIVE TRANSDUCER** **INDUCTIVE TRANSDUCERS**: - Principle of operation-construction details-characteristics and Applications of LVDT Induction potentiometer-variable reluctance transducer. **CAPACITIVE TRANSDUCERS**: - Principle of operation-construction details-characteristics of Capacitive transducers – different types & signal conditioning- Applications:-capacitor Microphone-capacitive pressure sensor.	18	CO1, CO2, CO3, CO4, CO5	K1, K2 ,K3, K4, K5, K6
V	**TRANSDUCERS FOR TEMPERATURE** Scale of temperature- Temperature transducers- Resistive temperature transducers-Thermistors- Thermoelectric transducers- Solid-state devices	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	**SELFSTUDY FOR ENRICHMENT:** **(Not to be included for External Examination)** Characteristics -Static characteristics-Dynamic characteristics Chemical / biological characterization - Thermal Sensors Recent- Trends in Sensor Technologies	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books:

1. Patranabis.D, *Sensors and Transducers,* Wheeler publisher.
2. Randy Frank, (1995) *Unsderstanding Smart Sensor,* Artech House Boston,London. Second edition
3. Usher.M.J and Keating.D.A (1996), *Sensors and Transducers Characteristics, Applications, Instrumentation, Interfacing* ,Macmillan Press Ltd. Second edition
4. DVS Murthy,(2013) *Transducers and Instrumentation,* PHI 2nd Edition

Reference Books:

1. Arun K. Ghosh,(2012) *Introduction to measurements and Instrumentation,* PHI, 4th Edition.
2. Helfrick.A.D and Cooper W.D, (2001) *Modern Electronic Instrumentation& Measurement Techniques*, PHI.
3. Hermann K.P. Neubert,(2012), *Instrument Transducers,* 2nd Edition, Oxford University Press.

Web References

1. https://www.geeksforgeeks.org/difference-between-sensor-and-actuator/
2. https://www.variohm.com/news-media/technical-blog-archive/difference-between-a-sensor-and-a-transducer

Pedagogy

Lecture, Seminar, Assignment and Power Point Presentation

Course Designer

Ms.R.A.KIRUTHIKA

SEMESTER II	INTERNAL MARKS: 25	EXTERNAL MARKS: 75		
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
22PPH2DSE2C	**MATERIAL CHARACTERIZATION AND MEASUREMENT TECHNIQUES**	**DSE-II**	**6**	**3**

Course Objectives

- To illustrate the basic knowledge of optical microscope and image formation.
- To demonstrate X-ray diffractometer and its applications.
- To analyze the concept on fluorescence.
- Examine the formation of SEM images.

Pre-requisites

- Basic understanding on structure of materials.
- Knowledge of the fundamentals of the electron microscope.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the Course, the Student will be able to	Cognitive Level
CO 1	Summarize the knowledge in basic concepts and experimental methods.	K2
CO 2	Make use of the knowledge of material characterization and measurement techniques.	K3
CO 3	Examine the instrumentation details of image formation techniques and application.	K4
CO 4	Explain structure of materials.	K5
CO 5	Discuss the latest developments in measurement techniques and to analyze the usage of materials.	K6

Mapping of CO with PO and PSO

COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	2	2	3	2	3	2	3	3
CO 2	3	3	3	2	3	3	3	3	3	3
CO 3	3	3	3	2	3	3	3	3	3	3
CO 4	3	3	2	2	3	3	3	2	3	3
CO 5	3	3	3	2	3	3	3	3	3	3

"1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation

"3" – Substantial (High) Correlation "-" indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**SCOPE OF OPTICAL METALLOGRAPHIC STUDIES:** Image formation - resolving power - numerical aperture - empty magnification - depth of focus - components of microscopes - principles of phase contrast - interference and polarized light microscopy - elements of quantitative metallography and image processing.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**X RAY DIFFRACTION AND THEIR APPLICATIONS:** X-ray - diffraction directions - diffraction methods - X-ray - diffraction intensities - factors affecting intensity - structure factor - Working principles of diffractometer - counters and cameras - Chemical analysis by X-ray diffraction and fluorescence - determination of particle size and micro/macro strains.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**STUDIES BY MOLECULAR LUMINESCENCE:** Introduction – Fluorescence and phosphorescence – Internal conversion – External conversion – Quenching – Theory – Relation between intensity of fluorescence and concentration – Calculation of results – Measurement of fluorescence – Spectrofluorometers – Advantages and limitations.	20	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**STUDIES BY ELECTRON MICROSCOPES:** Construction and working principles of transmission electron microscopes - Image formation - resolving power – magnification - depth of focus - elementary treatment of image contrasts - Bright field and dark field images- Scanning electron microscope –construction - interaction of electrons with matter - modes of operation - image formation of plane and fractured surfaces.	20	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	**METALLOGRAPHIC TECHNIQUES:** Optical metallography - image analysis - X-ray fluoroscopy – spectrometry – DTA DSC and TGA - working principle – applications - Types and applications of strain gauges.	14	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	**SELF STUDY FOR ENRICHMENT:** **(Not to be included for External Examination)** Moseley's law – Continuous and discontinuous spectra from electron beam sources – Factors affecting fluorescence and phosphorescence – principle and instrumentation of electron microscope.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books:

1. Michael Spencer, (1982). *Fundamentals of Light Microscopy*. Cambridge University Press, UK.
2. Joseph Goldstein, Dale E. Newbury, David C. Joy, Charles E. Lyman, Patrick Echlin, Eric Lifshin,
3. Linda Sawyer, Michael, J.R., (2003). *Scanning Electron Microscopy and X-Ray Microanalysis.* (3rd edition), Springer, US.
4. Cullity, B.D., and Stock, S.R., (2001). *Elements of X-Ray Diffraction.* (3rd edition), Prentice Hall, New York.
5. Hohne, G.W.H., Hemminger, W.F., Flammersheim, H.J., (2003), *Differential Scanning Calorimetry.* (2nd edition), Springer, US.
6. Champness, P.E., (2001). *Electron Diffraction in the Transmission Electron Microscope.* Garland Science,London.
7. Smallman, R.E., (1985). *Modern Physical Metallurgy.* (4th edition) Butterworth-Heinemann, UK. Philips,V.A., (1971), *Modern Metallographic Techniques and their Applications.* Wiley Interscience, New York.

Reference Books:

1. Sharma, B.K., (2013), *Instrumental methods of chemical analysis.* (29th edition), GOEL Publishing House, Meerut.

Web References

1. https://www.rp-photonics.com/numerical_aperture.html
2. https://physicswave.com/x-ray-diffraction-analysis-principle-instrument-and-applications/
3. https://conductscience.com/fluorescence-spectrophotometry-principles-and-applications/
4. https://www.slideshare.net/akhtarkamal94/scanning-electron-microscope-38294237
5. http://www.chem.latech.edu/~upali/chem466/TA/TA.pdf

Pedagogy

Chalk and Talk, Assignment, Group discussion and Tutorial session in the laboratory

Course Designer

Dr.N.MANOPRADHA

SEMESTER- III	INTERNAL MARKS : 25	EXTERNAL MARKS : 75		
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
22PPH3CC6	**STATISTICAL MECHANICS**	**CC-VI**	**6**	**5**

Course Objectives

- To understand the concepts of statistical thermodynamics
- To analyse the kinetic theory and Transport phenomena
- To impart the significance of classical statistical mechanics
- To gain the basic knowledge of phase transition and partition function
- To impart the application of quantum statistical mechanics

Pre-requisites

- A thorough understanding of thermodynamics
- Knowledge of thermodynamical relations.
- Commendable knowledge of three types of statistics.

Course Outcomes and Cognitive Levels Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO1	Differentiate between canonical and grand canonical ensembles and interpret the relation between thermodynamical quantities and partition Function	**K1,K2**
CO2	Justify the connection between thermodynamic quantities and classical statistical mechanics	**K3, K4**
CO3	Recall and apply the different statistical concepts to analyse the behaviour of ideal Fermi gas and ideal Bose gas and also to compare and distinguish between the three types of statistics.	**K4, K5**
CO4	Analyse the kinetic theory and Transport phenomena	**K5**
CO5	Examine and elaborate the effect of changes in thermodynamic quantities on the states of matter during phase transition	**K5**

MAPPING WITH PROGRAM OUTCOMES:

Cos	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO 1	PO 2	PO 3	PO 4	PO 5
CO1	3	3	3	1	1	2	3	1	1	3
CO2	3	3	3	1	1	2	3	1	1	3
CO3	3	3	3	1	1	2	3	2	1	3
CO4	3	3	3	1	1	2	3	2	1	3
CO5	3	3	3	1	1	2	3	1	1	3

"1" – Slight (Low) Correlation **"2" – Moderate (Medium) Correlation;**

"3" – Substantial (High) Correlation **"-" – Indicates there is no correlation.**

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**Kinetic Theory:** Binary collisions -Boltzmann transport equation and its validity - Boltzmann's H-theorem - Relation between H-function and entropy - Maxwell-Boltzmann distribution of velocities - Mean free path - Conservation laws - Zero order approximation - First order approximation-Transport phenomena - Thermal conductivity - Diffusion process - Viscosity - Brownian motion.	**18**	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
II	**Classical Statistical Mechanics:** Foundations of statistical mechanics - Specification of states of a system - Micro canonical ensemble - Phase space - Entropy - Connection between statistics and thermodynamics - Entropy of an ideal gas using the micro canonical ensemble - Entropy of mixing and Gibb's paradox.	**18**	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
III	**Methods of Ensembles: Partition Functions:** Introduction- Micro Canonical Ensemble -Entropy in Statistical Mechanics- Perfect gas in microcanonical ensemble -Partition Functions- Partition Function and thermodynamical quantities - Entropy of a perfect gas (Gibb's Paradox) -Gibb's canonical ensemble – Perfect mono atomic gas in Canonical ensemble -Equipartition theorem – Grand canonical ensemble -Perfect gas in Grand canonical ensemble – Comparison various ensembles	**18**	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
IV	**Quantum Statistical Mechanics:** Basic postulates of quantum statistical mechanics - Microcanonical ensemble - Canonical ensemble - Grand canonical ensemble - Bose - Einstein and Fermi Dirac grand partition functions - Bose - Einstein distribution - Fermi Dirac distribution-Maxwell Boltzmann distribution - Bose - Einstein gas - Fermi gas - Bose - Einstein condensation.	**18**	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	**Phase transition:** Triple point -Vander Waal's Equation and Phase transition- First and second order phase transitions - Ehrenfest equations- Critical exponent - Ising model - one dimensional Ising model -Yang and Lee theory of phase transitions - Landau theoryof Phase transitions	**18**	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

VI	**Self-Study for Enrichment** **(Not included for End Semester Examinations)** The basic equations connecting the translational, rotational, vibrational, and electronic properties of isolated (i.e.gas-phase) molecules to their thermodynamics-The most elementary models for describing cooperative behavior and phase transitions in gas-surface and liquid-liquid systems-The contributions of intermolecular forces to the thermodynamics of gases.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

TEXT BOOKS.

1. Satyaprakash,2003, *Statistical Mechanics,* Kedarnath and Ramnath Publishers.
2. Huang K., 2002, *Statistical Mechanics,* Taylor and Francis, London
3. Reif F, 1965, *Fundamentals of Statistical and Thermal Physics,* McGraw -Hill, New York.
4. Saxena A.K.,2016, *Introduction to thermodynamic and statistical Mechanics,* Narosa Publishers
5. Sinha K., 1990, *Statistical Mechanics,* Tata McGraw Hill, New Delhi.

REFERENCE BOOKS

1. Pathria R.K.,1996,*Statistical Mechanics*,2nd edition, Butter Worth Heinemann, New Delhi.
2. LandauL.D. and LifshitzE.M., 1969, *Statistical Physics,* Pergamon Press, Oxford.
3. Greiner W., Neise L.and Stoecker H.,*Thermodynamics and Statistical Mechanics,* Springer Verlang,New York.

WEB SOURCES

1. https://web.stanford.edu/~peastman/statmech/thermodynamics.html 3.
2. https://en.wikiversity.org/wiki/Statistical_mechanics_and_thermodynamics
3. https://en.wikipedia.org/wiki/Grand_canonical_ensemble
4. https://simons.hec.utah.edu/ITCSecondEdition/chapter7.pdf

Pedagogy

Lecture, Seminar, Assignment and power point presentation

Course Designer

Dr.R.MEENAKSHI

SEMESTER – III	INTERNAL MARKS : 25	EXTERNAL MARKS : 75		
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
22PPH3CC7	SOLID STATE PHYSICS	CC - VII	5	5

Course Objectives

- To understand the basic structure of crystals by crystal diffraction method
- To expose the students to the fundamentals of lattice vibrations
- To acquire the knowledge about dielectric and ferroelectric crystals
- To studythe different types of magnetic materials
- To gain the basic idea on superconductors and its applications

Pre-requisites

- Basic ideas about crystal structure
- Knowledge about types of materials
- Knowledge about bonding between the molecules

Course Outcome and Cognitive Level Mapping:

CO Number	CO Statement On the successful completion of course, the student will be able to	Cognitive Level
CO 1	Remember and understand the fundamental principles and crystal structure of the solid materials	K1,K2
CO 2	Analyze the mode of vibrations in the atoms	K3
CO 3	Able to differentiate between dielectrics, ferroelectric and anti-ferroelectrics	K4
CO 4	Develop and synthesize new materials for a requirement	K5 & K6
CO 5	Elaborate the concepts of superconductors materials	K6

Mapping of CO with PO and PSO

Cos	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	3	1	3	3	3	3	2	2
CO 2	3	3	3	1	2	3	3	2	2	2
CO 3	3	3	2	1	3	2	2	2	2	2
CO 4	3	3	2	1	2	2	2	3	2	2
CO 5	3	3	2	1	3	3	3	2	2	2

"1"-Slight (Low) Correlation **"2"-Moderate (Medium) Correlation**
"3"- Substantial (High) Correlation **"-"-indicates there is no correlation**

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIV ELEVEL
I	**Crystal structure** Basics of crystal systems -Bravais lattice - simple - body centered and face centered - cubic lattices primitive cell - Wigner Seitz cell - crystal structures and lattice with basis hexagonal close packed - diamond structure - point groups - space groups-Miller indices - reciprocal lattice - atomic scattering factor -structure factor –Bragg's law of XRD – XRD technique - Laue - powder and rotating crystal methods.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**Lattice Vibrations and Thermal Properties** Bloch theorem - Kronig - Penney model - vibrational modes of one dimensional line of atoms- linear diatomic lattice - acoustic and optical modes - quantization of lattice vibrations - phonon momentum - inelastic scattering of neutrons - classical theory of lattice heat capacity - Einstein and Debye theories - lattice thermal conductivity- electrical conductivity- thermal conductivity of metals - Wiedemann-Franz law.	14	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**Dielectrics and Ferroelectrics** Polarization-macroscopic electric field-local electric field at an atom- measurement of dielectric constant of a solid - Clausius-Mosotti relation – ferroelectric crystals- classification of ferroelectric crystals – displacive transitions- Landau theory of the phase transition – antiferroelectricity – ferroelectric domains- piezoelectricity.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**Magnetic Properties** Types of magnetism - Langevin's theory of diamagnetism and paramagnetism - quantum theory of paramagnetism – Hund's rule- origin of permanent magnetic moment - Weiss theory of ferromagnetism - the Bloch wall - ferromagnetic domains and hysteresis - ferrimagnetism.	14	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	**Superconductivity** Occurrence of superconductivity - properties of superconductors- effect of magnetic field - Meissner effect - Type I and type II superconductors - isotope effect - entropy - heat capacity and thermal conductivity. Energy gap - microwaveand infrared absorption - theoretical explanations: London's equations - penetration depth - coherence length, Cooper pairs - BCS theory - AC and DC Josephson effects - high temperature superconductors (basic concepts).	20	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

VI	**Self-Study for Enrichment** **(Not included for End Semester Examinations)** Cubic zinc sulphide structure – CeF_3 crystal structure – thermal conductivity of Quasi crystalline materials – ferroelectric applications in memory devices – recent developments in bio magnetism – SQUID.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Deckker A. J., (2000) *Solid State Physics,* Macmillan, 1st Edition, India.
2. Kittel.C, (2004) *Introduction to Solid State Physics,* John Wiley & Sons, Hoboken, New Jersey, U.S.
3. Puri.R.K & Babbar.V.K.,(2008) *Solid State Physics and Electronics,* S.Chand & Company, 1st Edition, New Delhi
4. Singhal R. L., (2003) *Solid State Physics,* Kedar Nath Ram Nath, 7 revised Edition,Uttar Pradesh, India.
5. Gupta Kumar, (2013) *Solid State Physics,* K Nath & Co, 9th edition, Meerut.
6. Pillai S. O., (2006) *Solid State Physics*, New Ag International (P) Ltd. Publishers, Revised Edition, New Delhi.

Reference Books

1. Ali Omar .M. S., (1975) *Elementary Solid State Physics,* Addison Wesley, 2nd Edition, U.S.
2. Azoroff L. V. (1993) *Introduction to solids,* TMH Publishing, 1st Edition, Chennai.
3. Ashroft N. W. and Mermin Holt N. D., (1987) *Solid State Physics,* Cenegage Learning, 1st Edition , U.S.

Web Resources

1. https://www.britannica.com/science/crystal
2. https://www.britannica.com/science/lattice-vibration
3. https://www.youtube.com/watch?v=H6w24ZVo_W8
4. https://iopscience.iop.org/article/10.1088/0034-4885/61/9/002/pdf
5. https://collegedunia.com/exams/diamagnetism-physics-articleid-8133
6. https://easyelectronics.co.in/superconductivity/
7. https://testbook.com/physics/superconductor-materials

Pedagogy

Lecture, Seminar, Assignment and power point presentation

Course Designer

MS. A. MARY GIRIJA

Semester: III	Internal Marks: 25		External Marks:75	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HOURS/ WEEK**	**CREDITS**
22PGPH3CCC2A	**CYBER SECURITY**	**CORE**	**3(T) + 2(P)**	**3**

Course Objective

- To develop skills in students that can help them plan, implement, and monitor cyber security mechanismsto ensure the protection of information technology assets.
- To expose students to governance, regulatory, legal, economic, environmental, social, and ethical contexts ofcyber security.
- To expose students to theresponsible use ofonline social media networks.
- To systematically educate the necessity to understand the impact of cyber-crimes and threats with Solutions in a global and societal context.
- To select suitable ethical principles, commit to professional responsibilitiesand human values, and contribute value and wealth for the benefit of society.

Prerequisites

Basic Knowledge of Cyber Security

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement	Cognitive Level
CO1	Understand the cyber security threat landscape	K1,K2
CO2	Develop a deeper understanding and familiarity with various types,cyber crimes, vulnerabilities, and remedies thereto.	K2, K3
CO3	Analyse and evaluate existing legal frameworks and laws on cyber security.	K4, k5
CO4	Analyse and evaluate the digital payment system security and remedial measures.	K4, K5
CO5	Analyse and evaluate the cyber security risks , plan suitable security controls	K4, k5

"1"-Slight (Low) Correlation **"2"- Moderate (Medium) Correlation**
"3"- Substantial (High) Correlation **"-"- indicates there is no correlation**

Syllabus:

Theory:

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**Overview of Cyber Security:** Cyber security increasing threat landscape, -Cyberspace, attack, attack vector, attack surface, threat, risk, vulnerability, exploit, exploitation, hacker., Non-state actors, Cyber terrorism, Protection of end user machine, Critical IT and National Critical Infrastructure, Cyber warfare, Case Studies.	9	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
II	**Cyber Crimes:** Cyber Crimes targeting Computer systems and Mobiles- data diddling attacks, spyware, logic bombs, DoS, DDoS, APTs, virus, Trojans, ransomware, data breach., Online scams and frauds- email scams, Phishing, Vishing, Smishing, Online job fraud, Online sextortion, Debit/credit card fraud, Online payment fraud, Cyberbullying, website defacement, Cyber-squatting, Pharming, Cyber espionage, Cryptojacking, Darknet- illegal trades, drug trafficking, human trafficking., Social Media Scams & Frauds- impersonation, identity theft, job scams, misinformation, fake news cyber crime against persons –cyber grooming, child pornography, cyber stalking., Social Engineering attacks, Cyber Police stations, Crime reporting procedure, Case studies.	9	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
III	**Cyber Law:** Cyber Crime and legal landscape around the world, IT Act, 2000 and its amendments. Limitations of IT Act, 2000. Cyber Crime and punishments, Cyber Laws and Legal and ethical aspects related to new technologies-AI/ML, IoT, Blockchain, Darknet and Social media, Cyber Laws of other countries, Case Studies.	9	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
IV	**Data Privacy and Data Security:** Defining data, meta-data, big data, non-personal data. Data protection, Data privacy and data security, Personal Data Protection Bill and its compliance, Data protection principles, Big data security issues and challenges, Data protection regulations of other countries- General Data Protection Regulations(GDPR),2016 Personal Information	9	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5

	Protection and Electronic Documents Act (PIPEDA)., Social media- data privacy and security issues.			
V	**Cyber security Management, Compliance and Governance:** Cyber security Plan-cyber security policy, cyber crises management plan., Business continuity, Risk assessment, Types of security controls and their goals, Cyber security audit and compliance, National cyber security policy and strategy.	9	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5
VI	**Self Study for Enrichment** **(Not included for End Semester Examinations)** **Case Studies**: Largest Cyber Attacks : Yahoo Data Breach, Equifax Data Breach, Wannacry Malware Attack, Simple Locker.	-	CO1 CO2 CO3 CO4 CO5	K1 K2 K3 K4 K5

Reference Books

1. Sumit Belapure and Nina Godbole, (2011). *Computer Forensics and Legal Perspectives*. 1 January 2011, Wiley India Pvt. Ltd.
2. Dorothy F. Denning, (1998). *Information Warfare and Security*. 10 December 1998, Addison Wesley.
3. Henry A. Oliver, (2015). *Security in the Digital Age: Social Media Security Threats andVulnerabilities*.11 August 2015 Create Space Independent Publishing Platform.
4. Natraj Venkataramanan and Ashwin Shriram, (2016). *Data Privacy Principles and Practice.* 1st Edition, CRC Press.
5. W.Krag Brothy, (2008). *Information Security Governance, Guidance for Information Security Managers*. 1st Edition, Wiley Publication.
6. Martin Weiss, Michael G.Solomon, (2015). *Auditing IT Infrastructures for Compliance*. 2nd Edition, Jones & Bartlett Learning.

Web References

1. https://www.tutorialspoint.com/principles-of-information-system-security
2. https://www.geeksforgeeks.org/principle-or-information-system-secutiry/
3. https://www.techtarget.com/searchsecurity/definition/cybersecurity
4. https://www.ukessays.com/essays/computer-science/analysis-of-the-yahoo-data-breaches.php
5. https://www.csoonline.com/article/3444488/equifax-data-breach-faq-what-happened-who-was-affected-what-was-the-impact.html
6. https://www.techtarget.com/searchsecurity/definition/WannaCry-ransomware
7. https://www.cloudflare.com/learning/ddos/syn-flood-ddos-attack/

Practicals:

List of Exercises: (Not included for End Semester Examinations)

1. Platforms for reporting cyber crimes.
2. Checklist for reporting cyber crimes online
3. Setting privacy settings on social media platforms.
4. Do's and Don'ts for posting content on Social media platforms.
5. Registering complaints on a Social media platform.
6. Prepare password policy for computer and mobile device.
7. List out securitycontrols for computer and implement technical securitycontrols in the personal computer.
8. List out security controls for mobile phone and implement technical security controls in the personal mobile phone.
9. Log into computer system as an administrator and check the securitypolicies in the system.

Web References

1. https://cybercrime.gov.in/
2. https://cybercrime.gov.in/webform/crime_onlinesafetytips.aspx
3. https://www.digitalvidya.com/blog/social-media-dos-and-donts/
4. https://www.medianama.com/2023/02/223-platform-grievance-appellate-committees-social-media/
5. https://www.ibm.com/topics/security-controls
6. https://docs.oracle.com/cd/E19683-01/817-0365/concept-2/index.html

Pedagogy

Chalk and Talk, Group discussion, Seminar & Assignment.

Course Designer

From UGC SYLLABUS

Semester -III	Internal Marks: 25		External Marks: 75	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**EDITS**
22PPH3CCC2B	**COMMUNICATION ELECTRONICS**	**CCC-II**	**5**	**4**

Course Objectives

- To comprehend the transmission of electromagnetic waves thorough different types of antenna
- To acquire knowledge about the propagation of waves through earth's atmosphere and along the surface of the earth
- To gain knowledge in the generation and propagation of microwaves
- To acquire knowledge about radar systems and its applications and also the working principle of colour television
- To understand the general theory and operation of satellite communication systems

Pre-requisites

- Knowledge of Regions of electromagnetic spectrum and its characteristics.
- Learn the working principle of fiber optics and its use in telecommunication
- Understand the elements of Display mechanism.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO 1	Recall and Understand the propagation of electromagnetic waves through skyand on earth's surface	K1, K2
CO 2	Apply the principle of radar in detecting locating, tracking, and recognizing objects of various kinds at considerable distances	K3
CO 3	Analyze the methods of generation of microwaves analyze the propagation of microwaves through wave guides	K4
CO 4	Compare the different types of optical fiber and also to justify the need of it-discover the use of optical fiber as wave guide	K5
CO 5	Show the importance of satellite communication and various principle display techniques.	K6

Mapping of CO with PO and PSO

Cos	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2	2	2	1	3	3	2	2	2
CO 2	2	2	1	2	1	3	1	2	2	2
CO 3	3	2	2	2	1	3	3	1	2	2
CO 4	3	1	3	2	1	1	3	2	2	2
CO 5	3	1	2	2	1	3	3	2	3	1

"1" - Slight (Low) Correlation **"2" - Moderate (Medium) Correlation;**
"3" - Substantial (High) Correlation **"-" - indicates there is no correlation.**

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**MODULATION AND MICROWAVES** **Modulation:** Theory of amplitude modulation – Frequency modulation – Phase modulation-Noise - Internal noise-External noise-noise calculation –noise figure-noise temperature. **Microwaves:** Microwave generation—Multi cavity Klystron-reflex klystron-magnetron travelling wave tubes (TWT) and other microwave tubes- MASER-Gunn diode-wave guides	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**ANTENNAS AND TELEVISION** Antenna equivalent circuits-coordinate system-radiation fields – Polarization- Power gain of Antenna-Hertzian dipole-Half wave dipole-Vertical antenna-Loop ferrite rod antenna-non-resonant antenna-driven array. **Television**: Colour TV transmission and reception-colour mixing principle-colour picture tubes- Delta gun picture tube.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**RADAR AND SATELLITE COMMUNICATION** Elements of a radar system and its equation-Performance Factors - radar transmitting systems-radar antennas- duplexers- radar receivers and indicators **Satellite:** Geo-stationary orbits - Power systems - Attitude control - satellite system link models-satellite system parameters	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**OPTICAL FIBER COMMUNICATION** Propagation of light in an optical fibre-acceptance angle- numerical aperture-step and graded index fibres-optical fibres as a cylindrical wave guide-wave guide equations in step index fibres - fibre losses and dispersion-applications.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	**DISPLAY TYPES** Inorganic Phosphors- Cathode Ray Tubes (CRTs)- Vacuum Florescent Displays- Filed Emission Displays-Plasma Display Panels - LED Display Panels- Inorganic Electroluminescent Displays	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	**SELF-STUDY FOR ENRICHMENT** (Not included for End Semester Examinations) Signal Broadcasting Techniques- CCTV Principle- Synthetic Aperture Radar(SAR)- Splicing techniques- Organic Electroluminescent Displays (OLEDs)	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Gupta and Kumar,(2008), *Handbook of Electronics*, Pragati Prakashan., Ist edition.
2. George Kennedy and Davis,(1988), *Electronic communication systems*,Tata McGraw Hill., 4th edition.
3. Taub and Schilling,(1991) Principles of communication systems, Tata Mc Graw Hill., second edition.
4. Kulkarani M, (1988) , *Microwave and radar engineering*, Umesh Publications, New Delhi., Third Edition.
5. Ghulathi R R,(2005), *Mono Chrome and colour television*, New Age International Publisher., Revised Edition.
6. Janglin Chen, Wayne Cranton, Mark Fihn(2016) , "*Handbook of Visual Display Technology*", Springer Publication.

Reference Books

1. Dennis Roddyand Coolen, (1995), *Electronics communications, Prentice Hall of India*., 4th Edition.
2. Wayne Tomasi,(1998), *Electronics communication System*, Prentice Hall of India., 4th edition.
3. Salivahanan S, Suersh Kumar N and Vallavaraj A, (2009), *Electronic Devices and Circuits*, Tata McGraw-Hill Publishing Company Limited, New Delhi., Second Edition.

Web References

1. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/
2. https://www.polytechnichub.com/difference-analog-instruments-digital-instruments/
3. https://www.youtube.com/watch?v=3Tlx_t4D11o
4. https://www.digimat.in/nptel/courses/video/117105131/L01.html
5. https://archive.nptel.ac.in/courses/108/101/108101092/

Pedagogy

Chalk and Talk, Seminar, Assignment, Power point Presentation, Group discussion and Quiz

Course Designer

Dr. R. Gayathri

Semester -III	Internal Marks: 25		External Marks: 75	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
22PPH3CCC2C	**PHYSICS OF SEMICONDUCTOR DEVICES**	**CCC-II**	**5**	**4**

Course Objectives

- To understand the fundamentals of semiconductor physics that will enable subsequent study of semiconductor devices
- To gain knowledge in semiconductor junction.
- To comprehend the various circuit configurations of transistor and diodes
- To acquire knowledge about Power electronic devices.
- To learn the latest technological changes in display devices.

Pre-requisites

- Knowledge on fundamental theory of semiconductors.
- Basic understanding of bipolar transistors
- Fundamental ideas on semiconductor devices

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO1	Describe and outline the structure of semiconducting materials.	K1,K2
CO2	Apply the knowledge of basic semiconductor material physics and understand fabrication processes.	K3
CO3	Examine the semiconducting devices and circuits, explain the working characteristics and use these principles in the complex circuits.	K4
CO4	Assess the electronic device problems and recommend the solutions.	K5
CO5	Design new materials for semiconductor devices	K5

Mapping of CO with PO and PSO

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	3	1	1	2	3	2	2	2	3
CO2	3	3	1	1	3	3	2	2	2	3
CO3	3	3	1	1	3	3	3	3	2	3
C O4	3	3	3	1	3	3	3	2	2	3
C O5	3	3	2	1	3	3	3	3	2	3

"1"-Slight (Low) Correlation **"2"- Moderate (Medium) Correlation**
"3"- Substantial (High) Correlation **"-"- indicates there is no correlation**

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**ENERGY BANDS AND CARRIERCONCENTRATION** Introduction to Semiconductor Devices- Semiconductor Materials - Basic Crystal Structures - Energy Bands - Intrinsic Carrier Concentration - Donors and acceptors	10	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
II	**CHARGE TRANSPORT IN MATERIALS** Carrier Drift -Carrier Diffusion- Generation and Recombination Processes -Continuity Equation - Thermionic Emission Process - Tunneling Process - Space-Charge Effect -High field effect	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
III	**P-N JUNCTION AND TRANSISTOR ACTION** Thermal Equilibrium Condition -Depletion Region - Depletion Capacitance - Charge Storage and Transient Behavior -Junction Breakdown – Hetero junction- Transistor Action - Static Characteristics of Bipolar Transistors - Frequency Response and Switching of Bipolar Transistor	17	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
IV	**MICROWAVE DIODES; QUANTUM-EFFECT AND HOT-ELECTRON DEVICES** Microwave Frequency Bands - Tunnel Diode - IMPATT Diode - Static and Dynamic characteristics - Transferred-Electron Devices - Quantum-Effect Devices - Resonant Tunneling Diode - Hot- Electron Devices	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	**LIGHT EMITTING DIODES, LASERS AND SOLAR CELLS** Radiative Transitions and Optical Absorption Light-Emitting Diodes - Liquid crystal display- Plasma display - Semiconductor Lasers - Photodetectors - Solar Cells-Silicon and Compound- Semiconductor Solar Cells - Third-Generation Solar Cells - Optical Concentration	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
VI	**SELF-STUDY FOR ENRICHMENT** (Not included for End Semester Examinations) Energy band gap for different materials - Electric current flow through a given medium - Thyristors and related power devices - Microwave materials for wireless applications - Applications of modern semiconducting devices -CCD - OLED	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

Text Books

1. Umesh K. Mishra, Jasprit Singh., (2008). "*Semiconductor Device Physics and Design",* Springer.
2. Simon M.Sze & Ming -Kwei Lee.,(2010)"*Semiconductor Devices : Physics and Technology*" (3rd Edition), John Wiley & Sons, Inc.

Reference Books

1. Simon M.Sze and Kwok K. Ng., (2007). "*Physics of Semiconductor Devices*", A John Wiley & Sons, Inc., Publication.
2. Marius Grundmann., (2016) "*The Physics of Semiconductors*", (3rdEdition), Springer International Publishing.
3. Donald A Neamen, (2007) "*Semiconductor Physics and Devices*", (4th Edition) , McGraw-Hill, New York.

Web References

1. https://archive.nptel.ac.in/courses/108/108/108108122/
2. https://www.electronics-tutorials.ws/diode/diode_1.html
3. https://physics.info/semiconductors/
4. http://www.fulviofrisone.com/attachments/article/403/The%20Physics%20of%20Semicondu_ctors.pdf
5. https://www.elprocus.com/3-different-types-displays-available/

Pedagogy

Chalk and Talk, Seminar, Assignment, Power point Presentation, Group discussion and Quiz

Course Designer

Dr.D. DEVI

SEMESTER-III	INTERNAL MARKS: 40	EXTERNAL MARKS: 60		
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
23PPH3CC3P	**GENERAL PHYSICS AND ELECTRONICS – II (P)**	**CP-III**	**6**	**5**

Course Objectives

- To determine elastic constants of materials using appropriate experimental setup.
- To verify the characteristics of semiconductor materials.
- To understand the application of operational amplifiers.
- To understand the concepts involved in arithmetic and logical circuits using IC's.

Pre-requisites

- Basic knowledge on usage of scientific apparatus.
- Hands on experience of simple general and electronics experiments.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO 1	Explain the aim of the study and the numerous inputs to the method for calculating a material's physical properties.	K2
CO 2	Construct and run the experiment.	K3
CO 3	Make use of the correct formula to compute the physical quantity, after writing a list of your observations and repeating the experiment.	K3
CO 4	Examine and evaluate the results acquired, and sketch variations as needed.	K4, K5
CO 5	Create and design electronic and electrical circuits for use in project work.	K6

Mapping of CO with PO and PSO

COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	2	1	3	2	2	1	1	3
CO 2	2	2	2	1	3	2	2	1	1	2
CO 3	3	3	2	1	3	3	2	1	1	2
CO 4	3	3	3	1	3	3	3	1	1	2
CO 5	3	3	3	1	3	3	3	1	1	3

"1" – Slight (Low) Correlation **"2" – Moderate (Medium) Correlation**

"3" – Substantial (High) Correlation **"-" – indicates there is no correlation.**

SYLLABUS

LIST OF EXPERIMENTS (Any 10)

1. Determination of L by Anderson method.
2. Polarizabilities of liquids by finding the refractive indices at different wavelength.
3. Magnetic susceptibility by Quincke's method.
4. Determination of specific rotatory power of liquid using Polarimeter.
5. Four probe method-determination band gap energy of a semiconductor.
6. Determination of Planck Constant – LED Method
7. Studyof Arithmetic Logic Unit.
8. Op-Amp 741 – Solving Simultaneous Equations.
9. Voltage Controlled Oscillator Using IC 555.
10. Four bit binary Up and Down Counter using IC7476.
11. Differential amplifier using Op-Amp.
12. Simplification of Boolean expression by Karnaugh map.
13. Construction of Current to Voltage and Voltage to Current Conversion using IC 741.
14. Studythe functional groups of material using FTIR spectrometer.
15. Determine the Redox Potential of a material using Cyclic Voltammetry.

Text Books

1. Ouseph, C.C., Rao, U.J., & Vijayendran, V., (2009). *Practical Physics and Electronics*. S.Viswanathan, Printers & Publishers Pvt Ltd.
2. Dr.Somasundaram, S., (2012). *Practical Physics*. Apsara Publications.

Reference Books

1. Dunlap, R.A., (1988). *Experimental Physics: Modern Methods*. Oxford University Press, New Delhi.
2. Jones, B.K., (1986). *Electronics for Experimentation and Research*. Prentice-Hall.
3. Zbar, P.B., Malvino, A.P., & Miller, M.A., (1994). *Basic Electronics: A Text-Lab Manual*. Tata Mc-Graw Hill, New Delhi.

Web References

1. https://vlab.amrita.edu/?sub=1&brch=192&sim=854&cnt=1
2. https://cds-iiith.vlabs.ac.in/exp/rotation-of-sugar/theory.html
3. http://vlabs.iitkgp.ac.in/coa/exp8/index.html
4. http://vlabs.iitkgp.ac.in/coa/exp13/index.html

Pedagogy

Demonstration, practical sessions and viva voce

Course Designer

Dr.N. MANOPRADHA

SEMESTER-III	INTERNALMARKS :25	EXTERNALMARKS :75		
COURSE CODE	**COURSETITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
22PPH3DSE3A	**PHYSICS FOR COMPETITIVE EXAMINATIONS**	**DSE-III**	**5**	3

Course Objectives

- To understand the fundamental concepts of physical sciences
- To gain the knowledge of experimental methods.
- To impart the concepts of the atomic & molecular physics.
- To focus on their principles of detectors.
- To acquire the knowledge in Spectroscopy.

Pre-requisites

- Fundamentals and Foundation ofthe physics for competitive examination.
- Learn the basic principles of Lattices.
- Understanding of the various application of Spectroscopy

Course Outcome and Cognitive Level Mapping

On the completion of the course, students will be able to

CO Number	CO Statement	Knowledge Level
CO1	Explain the digital techniques and applications	K1, K2
CO2	Discuss the atomic &molecular physics	K2
CO3	Explain the measurement methods	K3
CO4	Evaluate the error analysis	K4
CO5	Distinguish the different spectroscopies	K5

Mapping of CO with PO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO 1	2	3	3	3	2	2	2	3	2	2
CO 2	2	3	3	3	2	2	2	3	2	2
CO 3	2	3	3	3	2	2	2	3	2	2
CO 4	2	3	3	3	2	2	2	3	2	2
CO 5	2	3	3	3	2	2	2	3	2	2

"1" – Slight (Low) Correlation **"2" – Moderate (Medium) Correlation;**
"3" – Substantial (High) Correlation **"-" indicates there is no correlation**

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**ELECTRONICS:** Digital techniques and applications – Impedance matching– amplification and noise reduction – Lock in detector –Box-Car integrator – Modulation techniques	10	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
II	**CONDENSED MATTER PHYSICS :** Bravais lattices, Reciprocal lattice – Diffraction and the structure factor – Bonding of solids – Elastic properties, phonons, lattice specific hear – Free electron theory and electronic specific hear. Response and relaxation phenomena – Drude model of electrical and thermal conductivity – Hall effect and thermoelectric power – Electron motion in a periodic potential, band theory of solids : metals, insulators and semi-conductors.	20	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
III	**MEASUREMENT METHODS** Linear curve fitting – Nonlinear curve fitting - chi square fitting – Transducers and its type - Particle detectors – Measurement systems.	10	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
IV	**ATOMIC PHYSICS** Quantum states of an electron in an atom. Electron spin. Spectrum of helium and alkali atom. Relativistic corrections for energy levels of hydrogen atom, hyperfine structure and isotopic shift, width of spectrum lines, LS & JJ couplings. Zeeman, Paschen-Bach & Stark effects.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	**INFRARED & RAMAN SPECTROSCOPY** Vibrating diatomic molecule - Diatomic vibrating rotator - Linear and symmetric top molecules - Pure rotational Raman spectra - Linear molecules - Symmetric top molecules – Vibration of IR and Raman spectra - Surface Enhanced Raman spectroscopy. **NMR:** Basic principles - Shielding and de shielding effects - Chemical shift - Spin lattice and spin-spin relaxation - Coupling Constants	20	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

VI	**SELF-STUDY FOR ENRICHMENT** (Not included for End Semester Examinations) High-frequency devices (including generators and detectors) –Applications of Band theory – Merits of curve fitting - Spin-orbit coupling, fine structure - Applications of IR, Raman, NMR and SER spectroscopy.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

Text Books

1 . Malemnganba Chenglei.W,*UGC-CSIRNET (JRF&LS)Physical Science,* Arihant, 2016, Thirdedition.

2. Surekha Tomar, *CSIR-UGCNET/JRF/SET*, Physical Sciences, Upkar Prakashan,Recent edition.

3. Ghosal.S.N, *Atomic Physics,* S.Chand, 2007, Revised Edition.

4. Banwell. C.N, *Fundamentals of Molecular Spectroscopy*, McGraw Hill, 1981, 4th Edit ion.

5. Aruldhas.G, *Molecular Structure and Spectroscopy,* Prentice Hall, 2006, 2nd Edit ion.

6. Sathyanarayana. D.N,*Vibrational Spectroscopy*, New Age Inter-national, 2015, 3rd Edition

Reference Books

1. Nageshwara Rao. R, *CSIR-UGC*

2. *NET/SET (JRF&LS) PHYSICALSCIENCES*, Khanna Publishers,2019, Revised Edition

3. Sathyanarayana. D.N, *Vibrational Spectroscopy*, New Age Inter-national, 2015, 3rd Edition.

Web Resources

1. https://pravegaa.com/free-study-material/
2. https://testbook.com/csir-net/phys ical-science-study-material
3. https://toppersnotes.com/product/csirnetphyscience/?utm_source=GPMAX&utm_medium=CSIRNET Physical-
4. https://careerendeavour.com/net-physics-study- materials/
5. https://www.googleadservices.com/pagead/aclk?

Pedagogy

Chalk and Talk, Power point presentation, Assignment, Seminar and Quiz.

Course Designer

Dr. M. Kavimani

SEMESTER- III	INTERNAL MARKS : 25	EXTERNAL MARKS : 75		
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEKS	CREDITS
22PPH3DSE3B	CRYSTAL GROWTH AND THIN FILM PHYSICS	DSE -III	5	3

Course Objectives

- To understand the nucleation phenomena
- To develop the knowledge of experimental methods of crystal growth techniques
- To gain the growth aspects of thin film ideas.
- To acquire the Knowledge of Structural aspects.
- To develop the Knowledge about the applications of grown materials.

Pre-Requisites

- Basic knowledge in Solid State Physics.
- Basic Knowledge of kinematics.
- Understanding ofthe various application of Materials.

Course Outcome and Cognitive Level Mapping

On the successful completion of the course, the students will be able to:

CO Number	CO statement	Knowledge Level
CO1	Outline the basic knowledge of growth phenomena and discuss the theoretical aspects of nucleation , Growth, Structural and Application.	K1,K2
CO2	Apply the experimental ideas of low temperature solution growth mechanism and Melt Growth.	K3,K4
CO3	Analyze the concepts on vapour growth techniques	K3,K4
CO4	Explain the process ofthin films sample preparation method.	K4,K5
CO5	Formulate the latest developments in characterization techniques and analyze the usage of materials.	K4,K5

Course Outcome and Cognitive Level Mapping

Cos	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO 1	PO 2	PO 3	PO 4	PO 5
CO“1	3	2	2	2	3	2	2	2	2	2
CO 2	3	2	2	2	3	3	3	3	3	3
CO 3	3	2	2	2	3	3	3	3	3	3
CO 4	3	2	2	2	3	3	3	3	3	3
CO 5	3	2	2	2	3	3	3	3	3	3

“ 1” – Slight (Low) Correlation **“2” – Moderate (Medium) Correlation;**
“3” – Substantial (High) Correlation **“-” - indicates there is no correlation.**

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**CRYSTAL GROWTH PHENOMENA:** Nucleation - Homogeneous nucleation -Heterogeneous nucleation - Formation of nucleation - spherical nucleation - cylindrical nucleation - Growth kinetics - Singular and rough surface - Gibbs – Thomson equation - Growth from vapour – solutions - Classical theory of nucleation - Kossel, Stranski, Volmer (KSV) Theory - Burton, Cabrera and Frank (BCF) theory.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
II	**GROWTH OF SINGLE CRYSTAL:** **Solution Growth :** Selection of solvents and solubility – Meir's solubility diagram – Saturation and supersaturation - Growth by restricted evaporation of solvent - slow cooling of solution and temperature gradient methods **Vapour Growth:** Physical Vapour Deposition (PVD) - Chemical Vapour Deposition (CVD). **Melt Growth Techniques :** Czochralski pulling method – Bridgeman technique	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
III	**THIN FILM STRUCTURE:** Thin film growth stage – Deposition technique – physical method – Resistive heating – Electron beam gun – Laser gun evaporation – Flash evaporation – Sputtering – reactive sputtering - radio frequency sputtering - chemical method – Electro deposition –Eletroless plating – deposition by chemical reaction- Properties – Dielectric property – Optical property.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
IV	**STRUCTURAL ANALYSIS:** X-Ray diffraction studies (XRD) - Powder XRD equipment- Single XRD equipment -Examination of typical XRD pattern. Fourier transform infrared Analysis (FTIR) - Raman Spectroscopy - Elemental analysis – EDAX – SEM – TEM.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

V	**CHARACTERIZATION TECHNIQUE:** Micro Hardness Test - Vickers Hardness - Brinell Hardness - Knoop Hardness- Thermal analysis - Thermal gravimetric analysis (TGA) - Differential Thermal Analysis(DTA) - Refractive index – Pulsed Laser – Florescence Studies - Photo-sensitivity - Thermal properties- melting point (TGA) – Differential Scanning Calorimetry (DSC) – Optical test – Pulsed laser – florescence.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
VI	**SELF-STUDY FOR ENRICHMENT** (Not included for End Semester Examinations) Gibbs Thomson Equation – growth from melt - Chemical Vapour Transport – Preparation of TiO films.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5,

Text Books:

1. Santhanaragavan P.& P.Ramasamy (2001) *Crystal growth process &Methods* First edition KRU Publications, Kumbakonam
2. BriceJ.C. (1986) *Crystal Growth Processes* First edition John Wiley, New York.
3. Pamplin B.R. (1981) *Crystal Growth* First edition Pergamon Press, Oxford.
4. Goswami A. (2008) *Thin film fundamentals* First edition New Age, New Delhi
5. Yang Leng (2013) *Materials Characterization: Introduction to Microscopic &Spectroscopic Methods* First edition Wiley & Sons.

Reference Books

1. Orhring M. (2002) *Materials Science of Thin films* second *edition* Academic Press, Boston.
2. Sam Zhang, Lin Liand Ashok Kumar (2008) *Materials Characterization Techniques* first edition CRC Press.

Web References

2. **https://www.worldscientific.com/worldscibooks/10.1142/10127#t=aboutBook**
3. **https://pubs.rsc.org/en/content/articlelanding/2017/cp/c7cp01112a**
4. **https://www.alineason.com/en/knowhow/crystal-growth/**
5. **https://www.nasa.gov/mission_pages/station/research/station-science**

Pedagogy:

Lecture with Power point presentation, Group discussion, Online Assignment

Course Designer

Dr .S.Priya

Semester - III	Internal Marks: 25		External Marks: 75	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
22PPH3DSE3C	**WEATHER FORECASTING**	**DSE - III**	**5**	**3**

Course Objectives

- To provide awareness regarding the causes of different weather phenomenon
- To understand effects of different weather phenomenon
- To know the basic forecasting techniques
- To studythe classification of Global wind
- To know the basic idea of weather forecasting

Pre-requisites

- Basic knowledge on different weather phenomenon

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the Course, the Student will be able to	Cognitive Level
CO 1	Describe the basic concepts and physical parameters related to Atmosphere	K1, K2
CO 2	Examine the techniques of weather measurements	K3
CO 3	Explain the ideas and utilization of weather forecast monitoring	K4
CO 4	Estimate the various steps, causes of global warming	K5
CO 5	Make the awareness of various natural disorders	K6

Mapping of CO with PO and PSO

Cos	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	3	3	2	2	2	2	2	3	2	2
CO 2	3	3	2	2	3	3	3	3	2	2
CO 3	2	3	2	2	3	3	3	3	2	2
CO 4	2	3	2	2	3	3	3	3	3	3
CO 5	3	3	2	2	2	3	3	3	3	2

"1" – Slight (Low) Correlation **"2" – Moderate (Medium) correlation**
"3" – Substantial (High) Correlation **"-" indicates there is no correlation**

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**INTRODUCTION TO ATMOSPHERE** Elementary idea of atmosphere: physical structure and composition - Compositional layering of the atmosphere - Variation of pressure with height - Variation of pressure with air - Atmospheric pressure: its measurement - Requirements to measure air temperature - Temperature sensors: types - Cyclones and anticyclones: its characteristics.	17	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**INSTRUMENT AND MEASUREMENT OF WEATHER** Measurement of temperature: Thermometer - Measurement of pressure: Mercury barometer- Measurement of humidity: Hygrometer - Measurement of precipitation: Rain gauges - Measurement of wind velocity: Anemometer - Measurement of clouds: Weather satellite.	16	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**WEATHER SYSTEMS** Global wind systems and its components - Classification - Wind: speed, direction - Thunderstorms - Jet streams - Tropical cyclones - Tornadoes - Hurricanes.	13	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**CLIMATE AND CLIMATE CHANGE** Climate: Classification of climate change - Causes of climate change - Global warming - Air pollution - Aerosols - Ozone depletion - Acid rain - Environmental issues related to climate.	14	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	**BASICS OF WEATHER FORECASTING** Need of measuring weather - Types of weather forecasting - Weather forecasting methods - Criteria of choosing weather station - Satellites observations in weather forecasting - Weather maps - Uncertainty and predictability - Probability forecasts.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	**SELF-STUDY FOR ENRICHMENT** (Not included for End Semester Examinations) Weather Forecasting Applications: Air traffic - Severe Weather Alerts - Marine - Agriculture - Military application.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. I.C. Joshi, (2010). *Aviation Meteorology*. (3rd Edition), Himalayan Books, New Delhi.
2. Nicole Molders & Gerhard Kramm, (2014). *Lectures in Meteorology*. (1st edition) Springer International Publishing, Switzerland.
3. S.R. Ghadeker, (2001). *Meteorology*. Agromet Publishers, Nagpur.
4. Stephen Burt, (2012). *The weather observers Hand book.* (1st Edition) Cambridge University Press.

Reference Books

1. S.R. Ghadekar, (2005). *Text Book of Agrometeorology*. Agromet publishers, Nagpur.
2. John G. Harvey, (1995). *Atmosphere and Ocean*. The Artemis Press.

Web References

1. Meteorology - I.C.Joshi | sai ram - Academia.edu
2. Causes and Effects of Climate Change | United Nations
3. Climate Change and Associated Issues - INSIGHTSIAS (insightsonindia.com)
4. Global warming - Greenhouse Effect and Fossil Fuels | Britannica
5. Weather forecasting - Meteorology, Synoptic Weather Map, and International Meteorological Organization | Britannica

Pedagogy

Chalk and Talk, Powerpoint presentation, Assignment, Seminar and Quiz.

Course Designer

Dr. B. ANITHA

Semester -I	Internal Marks: 25		External Marks: 75	
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
22PPH3GEC1	Science of Materials	GEC - I	3	2

Course Objectives

- To develop the knowledge in material science and to understand the chemical structureand bonding between the molecules
- To gain cognition on the defects in materials
- To acquire the knowledge about the materials and its mechanical properties
- To identify the materials defects and given a simple set on explaining the non– destructive testing in materials
- To acquire the knowledge about the uses ofthe materials in the space

Pre-requisites

- Basic knowledge on different materials

Course Outcome and Cognitive Level Mapping

On the successful completion of the course, students will be able to:

CO Number	CO statement	Knowledge level
CO1	Remembering and understanding of the different types of crystal structure and bonding in solids and the different kinds of materials and their testing methods.	K1,K2
CO2	Analyze the different kinds of technological properties of materials	K2,K3
CO3	Classify the new materials in the material engineering and to understand their role in materials behavior ,analyze the type of bond, be able to explain its physical origin as well as strength	K2,K3
CO4	Evaluate the materials defects and given a simple set on explaining the non– destructive testing in materials	K3,K4
CO5	Analyze the nuclear materials and uses of the materials in the space	K4,K5

Mapping with Programme Outcomes

COs	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	3	3	3	3	3	3	2	2	3
CO 2	2	3	3	3	3	3	3	2	2	3
CO 3	2	3	3	3	3	3	3	2	3	3
CO 4	2	3	3	2	3	3	2	2	2	3
CO 5	2	3	3	2	3	3	2	2	2	3

"1" – Slight (Low) Correlation **"2" – Moderate (Medium) Correlation;**

"3" – Substantial (High) Correlation **"-" indicates there is no correlation.**

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**CRYSTALSTRUCTUREANDCHEMICALBONDS** Introduction to crystals – Classification of crystal system – Introduction to Bravais lattice –Lattice planes and Miller indices – Interplanar spacing in a cubic lattice – Cubic lattice – SC –BCC – FCC – Sodium chloride and Diamondcrystal structure– Bonding of solids (Ionic, Covalent, Metallic, Hydrogen and Vander Waal)	9	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
II	**TECHNOLOGICAL PROPERTIES:** Introduction to material science – Classification of engineering materials – Structure – Property relationships in materials - Stability and meta stability – Selection of materials – Weld ability –Machine ability–Formability– Castability.	9	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
III	**NEWMATERIALSANDPHASETRANSFORMATION** Metallic glass–Fiber reinforced materials– Metal matrix composites–SAW materials–Biomaterials– Ceramics. Nucleation and Growth - solidification - Allotropic transformation- isothermal transformation – tensitic transformation phase transformation in alloy steels.	9	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
IV	**MECHANICALPROPERTIESANDNON-DESTRUCTIVETESTING:** Mechanical properties -Tensile – Fatigue – Creep – plastic deformation mechanisms-methods of strengthening metals against yield – creep resistance – facture – fatigue failures – factors affecting mechanical properties of a material. **NON-DESTRUCTIVE TESTING:** Introduction – Radiographic methods- production of x- rays -ultrasonic methods-basic properties of sound beam - production of ultrasonic waves-Piezoelectric ultrasonic generator - magnetostriction ultrasonic generator-applications	9	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	**MATERIALS FOR NUCLEAR AND SPACE APPLICATIONS:** Nuclear fuels - fuel cladding- moderators, control materials -Coolants - shielding materials - Space programme - structural material and their properties - system requirements - extreme high materials for thermal protection – pressure vessels – Lubrication.	9	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

VI	**SELF-STUDY FOR ENRICHMENT** (Not included for End Semester Examinations) Measurement of mechanical properties - such as strength – hardness - Optical properties - refractive index-photo-sensitivity - Thermal properties melting point - conductivity - electrical properties resistance - conductivity - capacitance - chemical properties - pH - corrosion – resistance.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

TextBooks:

1. Arumugam. M (2009) *Material Science* first edition Anuradha agencies,Kombakonam
2. aghavan .V (1993) *Material Science and Engineering* fifth edition Prentice Hall.
3. Hayra Choudhury. S.K. (1991) *MaterialsScience andProcesses* first edition Indian Book Distributing

ReferenceBooks

1. Pillai .S.O (2005) *Solid State Physics* New Age International Private Limited sixth edition
2. Baldev Raj, T. Jayakumar & M. Thavasimuthu, (2002) , *Practical NDT Second edition,* Narosa publishing house , New Delhi.
3. Raghavan.V (2015), *Physical Metallurgy , third edition , PHI Learning.*

Web references

1. https://www.britannica.com/technology/materials-science
2. https://materialseducation.org/resources/what-is-materials-science/
3. https://engineering.princeton.edu/research/materials-science-and-engineering
4. https://www.mccormick.northwestern.edu/materials-science/

Pedagogy

Chalk and talk, power point presentation, assignment, seminar, interaction, problem solving

Course Designer:

Dr.S.PRIYA

Semester - IV	Internal Marks: 25		External Marks: 75	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
22PPH4CC8	**NUCLEAR AND PARTICLE PHYSICS**	**CC - VIII**	**6**	**5**

Course Objectives

- To demonstrate knowledge and understanding of the fundamental concepts of nuclear physics.
- To learn the concepts of nuclear models and nuclear force.
- To apply the role of nuclear fission in power production.
- To expose the students to the applications of nuclear reaction.
- To analyse the elementary particles according to quantum numbers.

Pre-requisites

- Knowledge about the concepts of nuclear model.
- Fundamental knowledge of currents in a network of conductors.
- Basic concept of radioactivity.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the Course, the Student will be able to	Cognitive Level
CO 1	Understand the properties and stability of nucleus, nuclear models and nuclear forces	K1, K2
CO 2	Apply the concept nuclear theory and analyze the construction of nuclear reactors.	K3
CO 3	Analyze the theory and applications of various radioactive decays	K4
CO 4	Analyze the elementary constituents of a nucleon based on several theories.	K4
CO 5	Evaluate the energy released during nuclear fission and fusion reactions	K5

Mapping of CO with PO and PSO

Cos	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2	3	3	3	2	2	2	2	2
CO 2	2	3	3	3	3	2	2	2	2	2
CO 3	3	3	3	3	3	3	3	2	2	2
CO 4	3	3	3	3	3	3	3	3	2	2
CO 5	3	3	3	3	3	3	3	3	2	2

"1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation

"3" – Substantial (High) Correlation "-" – indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**BASIC PROPERTIES OF NUCLEUS** Basic nuclear properties: Size, Shape, Charge distribution, Mass, Spin, Parity and Magnetic moment - Binding energy - Nuclear force - Exchange force - Yukawa's meson theory - Ground state of deuteron - Scattering ideas - Low energy n-p scattering - Phase shift - Scattering length - Spin dependence and charge independence of nuclear forces	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
II	**NUCLEAR DECAY AND RADIOACTIVITY** Theory of alpha disintegration- Geiger- Nuttal law - Gamow theory - Neutrino hypothesis - Fermi theory of beta decay -Sargent diagram - Orbital electron capture-non conservation of -Parity - Double beta decay - Gamma ray spectra and nuclear energy level - Radio active transition in nuclei - Nuclear isomerism - Internal conversion - Gamma ray spectroscopy - Mossbauer effect- Interaction of charged particles and X-rays with matter - Types and basic principles of particle detectors.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
III	**NUCLEAR REACTIONS AND NUCLEAR MODELS** Types of nuclear reactions - Conservation laws - reaction energetics – Q value - Threshold energy- nuclear reaction cross section - Level width - Compound nuclear theory - Reciprocity theorem - Breit-Wigner formula - Resonance theory -Semi empirical mass formula - Liquid drop model - Shell model - Evidences for shell model - Magic numbers - Collective model of a nucleus.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
IV	**FISSION AND FUSION REACTORS** Characteristics of fission - Mass distribution of fragments - Radioactive decay processes - Fission cross-section - Energy in fission - Bohr - Wheeler's theory of nuclear fission - Fission reactors - Thermal reactors - Homogeneous reactors - Heterogeneous reactors - Basic fusion processes - Characteristics of fusion - Solar fusion - Controlled fusion reactors.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	**ELEMENTARY PARTICLES** Types of interactions and classification of elementary particles - Quantum numbers (Charge, Spin, Parity, isospin, Strangeness, Hypercharge) - Gell-Mann - Nishijima formula - Baryons - Leptons - Invariance principle and symmetries - Invariance under charge, parity, time reversal (CPT) - Quark model - SU(2) and SU(3) symmetry - Types of quarks and their quantum numbers.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

VI	**SELF STUDY FOR ENRICHMENT** (Not to be included for End Semester Examination) Repulsion at short distances - Disposal of nuclear wastes - Theory of Stripping and pick-up reactions - evolution and life cycle of a star - Gell-Mann and Okubo mass formula.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

Text Books

1. D.C Tayal(2011), *Nuclear physics*(2nd edition), Himalaya Publishing House, New Delhi.
2. S.N. Ghoshal(2003), *Nuclear Physics*(2nd edition), S. Chand and Co., New Delhi.
3. V. Devanathan(2008), *Nuclear Physics*(2nd edition), Narosa publishing house, New Delhi.

Reference Books

1. Arthur Beiser, Shobit Mahajan and S Rai Choudhury (2017), *Concepts of Modern Physics*(7th edition),, Tata McGraw Hill.
2. R.R. Roy and B.P. Nigam(2014), *Nuclear Physics theory and experiment*(2nd edition), New Age International, NewDelhi

Web References

1. https://ocw.mit.edu/courses/8-701-introduction-to-nuclear-and-particle-physics-fall-2020/
2. https://nptel.ac.in/courses/115103101
3. https://www.classcentral.com/course/swayam-nuclear-and-particle-physics-9873
4. https://www.coursera.org/courses?query=nuclear

Pedagogy

Chalk and Talk, Assignment, Group discussion and quiz

Course Designer

Dr.R.Gayathri

Semester IV	Internal Marks: 25			External Marks: 75
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
22PPH4CCC3A	**ADVANCED OPTICS AND SPECTROSCOPY**	**CCC - III**	**6**	**4**

Course Objectives

- To understand the light-matter interaction in nonlinear regime.
- To develop the underlying concepts from the perspectives of classical electrodynamics and advanced quantum mechanics.
- To acquire knowledge on harmonic generation and their applications.
- To understand the principles and theory of different spectroscopic method.
- To procure knowledge on advanced level spectroscopic techniques.

Pre-requisites

- Knowledge about the basic concepts of electromagnetic radiation.
- Fundamental knowledge of the different properties of light waves and atomic spectra.
- Basic knowledge of quantum mechanics.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the Course, the Student will be able to	Cognitive Level
CO 1	Understand and explain the fundamental concepts and applications of spectroscopic methods.	K1, K2
CO 3	Illustrate nonlinear phenomena from the fundamental perspective of quantum mechanics.	K2
CO 4	Examine a detailed physical and mathematical understanding of a variety of systems and processes in a range of advanced topics in optics.	K4
CO 2	Apply the knowledge acquired and use spectroscopic instruments to examine and develop new materials.	K3
CO 5	Appraise the ability to perform research and development projects using advanced theoretical and experimental skills and tools.	K5

Mapping of CO with PO and PSO

Cos	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO 1	PO 2	PO 3	PO 4	PO 5
CO 1	2	2	2	2	2	3	3	2	2	2
CO 2	2	1	2	2	2	3	3	2	2	2
CO 3	3	2	3	3	2	2	3	3	2	2
CO 4	3	3	3	3	3	2	2	3	3	2
CO 5	3	3	3	3	3	3	2	3	3	3

"1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation

"3" – Substantial (High) Correlation "-" – indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	Cos	COGNITIVE LEVEL
I	**THE NONLINEAR OPTICAL SUSCEPTIBILITY:** Introduction to Nonlinear Optics – Description of Nonlinear Optical Processes –Definition of the Nonlinear susceptibility – Properties of the nonlinear susceptibility – Time-Domain description of optical nonlinearities - The wave equation for nonlinear optical media – The coupled-wave equation for Sum- Frequency generation	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
II	**SECOND-ORDER OPTICAL NONLINEARITIES:** Phase matching – Quasi-phase-matching – The Manley-Rowe relations – Sum-Frequency generation -Second-harmonic generation –Difference-frequency generation and parametric amplification – Nonlinear optical interactions with focused Gaussian beams.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
III	**MICROWAVE SPECTROSCOPY:** Rotation of molecules-Rotational spectra - Rigid and non-rigid diatomic rotator-Intensities of spectral lines- Effect of Isotopic substitution-Polyatomic molecules (Linear, symmetric top and asymmetric top)-Chemical analysis by microwave spectroscopy- Techniques and instrumentation- microwave oven.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
IV	**INFRARED SPECTROSCOPY:** Vibration of Diatomic molecules-Simple Harmonic Oscillator- Anharmonic oscillator-Diatomic vibrating rotator- The vibration-rotation spectrum-Interactions of rotations and vibrations-The vibrations of polyatomic molecules-Influence of rotation on the Vibrational spectra of linear and symmetric top molecules-Analysis by infrared techniques-Instrumentation-FTIR spectroscopy.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	**RAMAN SPECTROSCOPY:** Classical and quantum mechanical picture of Raman effect - Polarizability-Pure rotational Raman spectra- Vibrational Raman Spectra-Raman activity of vibrations of CO_2 and H_2O-Rule of mutual exclusion-Overtone and combination vibrations- Rotational fine structure -Vibrations of spherical top molecule-structure determination from Raman and IR spectroscopy-techniques and instrumentation-FT Raman spectroscopy - Surfaces for SERS study-SERS microbes Surface selection rules.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
VI	**SELF STUDY FOR ENRICHMENT:** (Not to be included for External Examination) Application of FTIR Spectroscopy- Atomic emission Spectroscopy - Difference between atomic absorption spectra and atomic emission spectra - Numerical estimate of nonlinear optical quantities - Applications of second harmonic generation	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

Text Books

1. Robert W Boyd, (2015). *Nonlinear Optics* (3rd edition), Academic Press**,** United States.
2. Murti Y V G S, Vijayan C, (2021). *Physics of Nonlinear Optics (*2nd edition*)*, Springer Nature, Switzerland.
3. Banwell C.N and Mc Cash E.M, (2013), *Fundamentals of Molecular Spectroscopy*, (4thedition), Tata Mc Graw-Hill, New Delhi.
4. Aruldhas G, (2008), *Molecular structure and spectroscopy*, Prentice Hall of India Pvt. Ltd., New Delhi
5. Sindhu P S, (2006), *Fundamentals of Molecular Spectroscopy*, (4thedition), New Age International Publishers, New Delhi.

Reference Books

1. Shanmuganathan Rajasekar, Juan C Vallejo, (2016). *Nonlinear Resonances* (1st edition), Springer International Publishing
2. Guo Y, Kao C K, Li E H,Chiang K S, (2002). *Nonlinear Photonics* (1st edition), Springer.
3. Shen Y R, (2002). *Principles of Nonlinear Optics* (1st edition), Wiley Interscience.
4. Kaur H, (2009), *Spectroscopy*, (5th edition), A Pragati Prakashan, Uttarpradesh, India
5. Engel T. (2015), *Quantum Chemistry and Spectroscopy*, (3rd edition), Pearson, New York.

Web References

1. http://www.soest.hawaii.edu/HIGP/Faculty/sksharma/GG711/GG711Spectroscopy03Vibrational.pdf
2. https://archive.nptel.ac.in/courses/104/108/104108078/
3. https://mpl.mpg.de/fileadmin/user_upload/Chekhova_Research_Group/Lecture_4_8.pdf
4. http://jonsson.eu/research/lectures/lect8/web/
5. https://www.rp-photonics.com/frequency_doubling.html

Pedagogy

Chalk and Talk, Assignment, Power Point Presentation, E-content, Group discussion and quiz.

Course Designer

1. Dr.G.Maheswari
2. Dr.D.Devi

Semester- IV	Internal Marks: 25			External Marks: 75
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
22PPH4CCC3B	**NANOPHYSICS**	**CCC-III**	**6**	**4**

Course Objectives

- To introduce the fundamentals of nanoscale systems and various dimensionality of matters and structures
- To understand the carbon nanostructures and their properties.
- To learn the structures and properties of nanomaterials.
- To get a qualitative idea on the top-down and bottom-up approach of preparing nanomaterials.
- To study the fundamental concepts of energy conversion systems and different energy storage methods.

Pre-Requisites

- Basic knowledge in Solid State Physics.
- Fundamental ideas about the various dimensionality of matters and structures.
- Able to develop the idea on the working of storage devices.

Course Outcome

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the Course, the Student will be able to,	Cognitive Level
CO 1	Understand the basic of nanoscience, nanostructures and explore the different types of nanomaterials that should comprehend the surface effects of the nanomaterials.	**K1, K2**
CO 2	Understand the process of nanomaterials, formation of carbon nanostructures, fabrication of nanomaterials with their characterization techniques.	**K2**
CO 3	Apply the concepts on classification of nanomaterials, properties of nanostructures, synthesis techniques using physical, chemical approaches and the structural, microscopic effects of the nano-products with its application in energy conversions.	**K3**
CO 4	Analyze the quantum confinement, properties of the nano-products, various characterization techniques and applications in storage devices.	**K4**
CO 5	Analyze the concepts of nanoscience and technology, the structure of C60, the process and mechanism of synthesis, the spectroscopic characterization techniques and in the field of solar cells, batteries. .	**K4, K5**

Mapping of CO with PO and PSO

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO 1	2	3	3	3	3	3	3	3	3	3
CO 2	2	3	3	3	3	3	3	3	3	3
CO 3	2	3	3	3	3	3	2	3	3	3
CO 4	2	3	3	2	3	3	2	3	3	3
CO 5	2	3	3	2	3	3	2	3	3	3

"1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation
"3" – Substantial (High) Correlation "-" - indicates there is no correlation.

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**INTRODUCTION TO NANOMATERIALS** Fundamentals of NANO-Historical Perspective on Nanomaterial and Nanotechnology-Classification of Nanomaterials-Metal and Semiconductor Nanomaterials-2D, 1D, 0D nanostructured materials-Quantum dots-Quantum wire-Quantum well-Surface effects of nanomaterials	**18**	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5**
II	**CARBON NANOSTRUCTURES AND PROPERTIES** Carbon molecules-Carbon bond-C_{60}: Discovery and structure of C_{60} and its crystal-Superconductivity in C_{60}-Carbon Nanotube-Fabrication-Structure-Electrical Properties-Vibrational Properties-Mechanical Properties	**18**	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5**
III	**SYNTHESIS OF NANOMATERIALS** **Top down and Bottom-up approach** **Physical Method:** High energy ball milling-Laser Ablation- Molecular Beam Epitaxy (MBE). **Chemical Methods:** Sol-Gel method-Solvothermal Synthesis-Hydrothermal Synthesis-Sonochemical Synthesis-Microwave Synthesis-Co-Precipitation	**18**	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5**
IV	**CHARACTERIZATION OF NANOMATERIALS** **Structural Characterization:** Powder X-ray	**18**	**CO1** **CO2** **CO3**	**K1** **K2** **K3**

	diffractometer-FTIR spectrometer. **Microscopic Analysis:** Scanning Electron Microscopy (SEM), Energy Dispersive x-ray spectroscopy (EDS), Transmission Electron Microscopy (TEM). **Optical Analysis:** UV–Visible spectrophotometer		**CO4** **CO5**	**K4** **K5**
V	**NANOTECHNOLOGY FOR ENERGY CONVERSION AND STORAGE DEVICES** **Photovoltaic Systems:** Principles of photovoltaic energy conversion (PV)-Types of photovoltaic cells-Physics of photovoltaic cells-Organic photovoltaic cells-Sensitized Solar Cells (SSC). Energy Storage System-Batteries: Energy Storage Devices-Primary and Secondary Batteries (Lithium-ion Batteries)	**18**	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5**
VI	**SELF STUDY FOR ENRICHMENT (Not to be included for External Examination)** MXenes-Nano Electro Mechanical systems (NEMs)-Physical properties of Nanomaterials: Melting points, specific heat capacity, and lattice constant- Chemical Vapour Deposition (CVD)- Photoluminescence, Raman- Electrochemical sensors – Nano-biosensors- Rechargeable batteries.	-	**CO1** **CO2** **CO3** **CO4** **CO5**	**K1** **K2** **K3** **K4** **K5**

Text Books

1. Pradeep T, (2012), *A textbook of Nanoscience and Nanotechnology*, Tata McGraw-Hill Publishing Co.
2. Shah M. A. & Ahmad, T. (2010), *Principles of nanoscience and nanotechnology*, Narosa Publishing House Pvt Ltd.
3. Poole C. P. and Ownes F. J. (2003), *Introduction to Nanotechnology*, Wiley Reprint (2014).
4. Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons, Burkhard Raguse, (2005), *Nanotechnology: Basic Science and Emerging Technologies*, Overseas Press.
5. Brabec C, Dyakonov V, Scherf U, (2014), *Organic Photovoltaics: Materials, Device Physics, and Manufacturing Technology*, 2nd Edition, Wiley VCH.
6. Conway B E, (1999), *Electrochemical supercapacitors: Scientific Fundamentals and Technological Applications*, Kluwer Academic Plenum publisher, New York.
7. Linden D. Thomas Reddy B, (2002), *Handbook of Batteries*, 3rd Edition, McGraw-Hill, New York.

Reference Books

1. Rao M. S. R. & Singh, S. (2017), *Nanoscience and nanotechnology: Fundamentals to frontiers*. Wiley Publishing.
2. Booker R. & Boysen, E. (2005), *Nanotechnology*, Wiley Publishing Inc.
3. Fendler J. H. (2007), *Nanoparticles and nanostructured films: Preparation, Characterization and Application*s, John Wiley and Sons.
4. Murty, B. S. et al. (2012), *Textbook of Nanoscience and Nanotechnology*, Universities Press.
5. Diwan P. & Bharadwaj, A. (2005), *The Nanoscope (Encyclopedia of nanoscience and nanotechnology)*, Vol. IV – Nanoelectronics. Pentagon Press.
6. C. Brabec, V. Dyakonov, U. Scherf, *Organic Photovoltaics: Materials, Device Physics, and Manufacturing Technology*, 2nd Edition, Wiley VCH, (2014).
7. Manthiram A, (2000), *Science and Technology of Lithium Batteries-Materials Aspects: An Overview*, Kulwer Academic Publisher.

Web References

1. https://nptel.ac.in/courses/118/102/118102003/
2. https://www.classcentral.com/course/swayam-structural-analysis-of-nanomaterials-14310
3. https://nptel.ac.in/courses/113/107/113107081/
4. https://nptel.ac.in/courses/112/107/112107283/

Pedagogy

Chalk and talk, PPT, Expert Lectures, Online Seminars, Quiz, Assignment and Group discussion.

Course Designer

Dr. R. MEKALA

SEMESTER - IV	INTERNAL MARKS: 25		EXTERNAL MARKS: 75	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**CREDIT**
22PPH4CCC3C	**SPACE PHYSICS**	**CCC - III**	**6**	**4**

Objectives

- To develop the underlying concepts of the solar system and planetary atmospheres.
- To understand the solar wind interaction with planets.
- To study the concepts of energy deposition techniques.
- To understand the quantitative behavior of different space physics phenomena using various analysis methods.
- To acquire knowledge about absorption in stellar atmospheres.

Pre-requisites

- Basic Knowledge about the Planetary System
- Fundamental Knowledge of the basic properties of the Sun
- Knowledge about the atmosphere of Stars

Course Outcomes

CO Number	CO Statement On the successful completion of the course, students will be able to	Knowledge Level
CO1	Explain the principal environments of the solar system.	K1
CO2	Illustrate the physical theories that control the qualitative properties of different space plasma phenomena.	K2
CO3	Develop an understanding of how space physics has a practical impact on everyday life in the field of space weather.	K3
CO4	Analyze the quantitative behavior of different space physics phenomena using various analysis methods.	K4
CO5	Identify ways in which experimental studies of space physics phenomena have advanced our understanding of basic plasma physics in the field of research.	K5

Mapping with Programme Outcomes

COs	PO1	PO2	PO3	PO4	PO5
CO1	3	3	3	2	1
CO2	3	3	2	3	1
CO3	3	3	2	1	1
CO4	3	3	3	2	2
CO5	3	3	3	2	1

"1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation
"3" – Substantial (High) Correlation "-" – indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	Cos	COGNITIVE LEVEL
I	**Sun and Planetary System:** Solar atmosphere - Solar corona - Solar Electromagnetic radiation - Solar cycles and solar variability - Solar Energetic particles - Magnetic field energy - Planetary exploration - Characteristics of the planets - Bulk atmospheric composition - Planetary magnetic fields.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
II	**Solar wind interaction with planets:** Equations of Magnetohydrodynamics - Formation of Bow shock - Interaction with magnetized planets - Interaction with non-magnetized planets - Motion of charged particles in the electromagnetic field and ring current.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
III	**Plasma Waves:** Plasma waves in planetary magnetospheres - Plasma environment and outer planets- plasma waves at Venus, Mars, Mercury – Wave- particle interaction - Magnetohydrodynamics (MHD) waves - Plasma instabilities - Applications of Plasma.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
IV	**Energy deposition by Charged particles:** Collision cross section - Time-dependent perturbation theory - The Born Approximation - Semi-empirical electron impact cross-section - Energy deposition techniques - CSDA and Loss function - Analytical yield spectrum - Charge transfer - Electronic Recombination.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	**Atmosphere of Stars:** Introduction – Some Important Definitions – The equation of transfer – The solution of the equation of transfer – Absorption in Stellar Atmospheres – Continuous absorption – Analysis of Spectral line Broadening – The curve of growth – Stellar Temperatures – Chemical composition of Stars.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
VI	**Self-study for enrichment:** (Not to be included in External Examination) Variable of Stars – A Survey of Variable Stars as a Whole – Structure and Evolution of Stars	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

Textbooks

1. Singhal. R.P., (2015), Elements of Space Physics, PHI LearningPrivate Limited.
2. Baidyanath Basu., (2013) An Introductionto Astrophysics, PHI LearningPrivate Limited.

Reference books

1. Margaret G.Kivelson Christopher T. Russell, (1995), Introduction to Space Physics (2nd Edition), CambridgeUniversitypress, USA.
2. Steven Weinberg, (2008), Gravitation and cosmology (1st Edition), Wiley, USA.
3. Raychaudhuri. A.K., Banerji. S., Banerjee. A., (2003), General Relativity (1st Edition), Astrophysics and Cosmology, Springer.

Web Resources

1. **https://www.astrosen.unam.mx/~aceves/verano/libros/SpacePlasma.pdf**
2. **https://www.youtube.com/watch?v=Ta_OEZTqB5w**
3. **https://www.youtube.com/watch?v=ZsSooLxVae4**
4. **https://science.nasa.gov/astrophysics/**

Pedagogy

Chalk and talk, Assignment, PowerPoint presentation, Group discussion, Seminar

Course Designers:

Dr.M.Kavimani

SEMESTER-IV	INTERNAL MARKS: 40	EXTERNAL MARKS: 60		
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
23PPH4CC4P	**ELECTRONICS (P)**	**CP-IV**	**6**	**5**

Course Objectives

- To understand the different types electronic devices.
- To study the different applications of operational amplifier circuits.
- To acquire knowledge about combinational logic circuits.
- To learn about sequential logic circuits.
- To understand the concepts involved in logical circuits using IC's.

Pre-requisites

- Basic knowledge on usage of scientific apparatus.
- Hands on experience of simple general and electronics experiments.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO1	Acquire basic knowledge of digital logic levels and its application.	K2
CO2	Analyse and construct combinational logic circuits.	K3,K4
CO3	Demonstrate practical skills in functioning and testing the digital system	K5
CO4	Evaluate the results acquired.	K5
CO5	Take projects in electronics relevant to industrials.	K6

Mapping of CO with PO and PSO

COs	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO 1	3	3	2	1	3	2	2	1	1	3
CO 2	2	2	2	1	3	2	2	1	1	2
CO 3	3	3	2	1	3	3	2	1	1	2
CO 4	3	3	3	1	3	3	3	1	1	2
CO 5	3	3	3	1	3	3	3	1	1	3

"1" – Slight (Low) Correlation "2" – Moderate (Medium) Correlation

"3" – Substantial (High) Correlation "-" – indicates there is no correlation.

SYLLABUS

LIST OF EXPERIMENTS (Any 10)

1. Verify the Demorgan's theorems and reduce the Boolean expression.
2. Construction and study of phase Shift Oscillator using IC 741.
3. Study of the Digital to Analog converter (R-2R and Weighted method).
4. Study of Multiplexer and Demultiplexer.
5. Study of Encoder and Decoder.
6. Study of the R-S, clocked R-S and D-Flip flop using NAND gates.
7. Study of the J-K, D and T flip flops using IC 7476/7473.
8. Construction and study of Half Adder and Full Adder using NAND & NOR Gates.
9. Construction and study of Half Subtractor and Full Subtractor using only NAND & NOR Gates.
10. Study of BCD to Seven segment display.
11. Study of the I-V Characteristics and efficiency of solar cell.
12. Construction and study of Schmitt trigger using IC 555.

Text Books

1. Ouseph, C.C., Rao, U.J., & Vijayendran, V., (2009). *Practical Physics and Electronics*. S.Viswanathan, Printers & Publishers Pvt Ltd.
2. Dr.Somasundaram, S., (2012). *Practical Physics*. Apsara Publications.

Reference Books

1. Dunlap, R.A., (1988). *Experimental Physics: Modern Methods*. Oxford University Press, New Delhi.
2. Jones, B.K., (1986). *Electronics for Experimentation and Research*. Prentice-Hall.
3. Zbar, P.B., Malvino, A.P., & Miller, M.A., (1994). *Basic Electronics: A Text-Lab Manual.* Tata Mc-Graw Hill, New Delhi.

Web References

1. http://vlabs.iitkgp.ernet.in/dec/exp3/index.html
2. https://he-coep.vlabs.ac.in/exp/decoders-encodersmultiplexer-demultiplexer/theory.html
3. https://de-iitr.vlabs.ac.in/exp/half-full-adder/
4. https://de-iitg.vlabs.ac.in/exp/bcd-to-led/simulation.html

Pedagogy

Demonstration, practical sessions and viva voce

Course Designer

Dr.N.Manopradha

Semester - IV	INTERNAL MARKS: 25		EXTERNAL MARKS: 75	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
22PPH4GEC2	**TROUBLESHOOTING AND REPAIRING DOMESTIC APPLIANCES**	**GEC - II**	**3**	**2**

Course Objectives

- To gain awareness about domestic appliances.
- To learn the fundamentals of different domestic appliances operation andfunction.
- To develop knowledge of the maintenance of domestic appliances.
- To learn the utilization of different domestic appliances.
- To raise awareness about energy conservation.

Pre-requisites

- Knowledge of the basics of electricity.
- Fundamental ideas of physics in day-to-day life.
- Basic knowledge on the usage of domestic appliances.

Course Outcomes

CO Number	CO Statement On the successful completion of the Course, the students will able to,	Cognitive Level
CO 1	Remember the fundamental principles of electricity, electronics, and the operation of electrical equipment and applications.	**K1**
CO 2	Interpret the concepts of electronic hardware components and functions.	**K2**
CO 3	Solve the issue of various domestic appliances.	**K3**
CO 4	Analyze the problem of energy consumption in appliances.	**K4**
CO 5	Estimate the energy consumption of domestic appliances based on electricity.	**K5**

Mapping of CO with PO and PSO

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	2	1	2	2	3	3	2	1	2
CO2	2	2	2	2	3	3	3	2	2	3
CO3	3	2	1	2	3	3	3	2	2	3
CO4	3	2	2	2	3	3	3	2	1	3
CO5	3	2	1	2	3	3	3	2	2	3

"1" – Slight (Low) Correlation "2" – Moderate (Medium) correlation

"3" – Substantial (High) Correlation "-" – indicates there is no correlation

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**ELECTRICITY** Electric Charge - Voltage - Electric Current - Ohm's Law - Electric Potential - Types of wiring – ISI Rules - Megger testing - Earthing - Serial Circuit - Parallel Circuit - Transformer - Working Principle - Types (Phase , Core, Cooling).	9	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
II	**ELECTRICAL AND ELECTRONIC COMPONENTS** Active and Passive Components: Resistors -Capacitors - Fuses - Relays - Inductors - Semiconducting Devices: Diodes - Types -Transistors - Types - Integrated Circuits - Digital ICs for logic gates - Comparison of electrical and electronic device.	9	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
III	**SOLDERING/ DE- SOLDERING TECHNIQUES** Principles of solder connections - Soldering Printed Circuit Boards (PCB) - Types of Solder - Types of PCB - Soldering flux - Soldering Irons - Flux removal after soldering - De - Soldering - Hazards involved in soldering - Safety, health and medical aspects in soldering.	9	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
IV	**FUNCTIONALITY OF ELECTRICAL EQUIPMENT** Main Components of a Tube Light - Solar powered street lights - Water Heater - Iron box - Purifier - Air Conditioner - Common occurring faults - Possible causes, testing and repairs.	9	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	**FUNCTIONALITY OF MOTOR APPLIANCES** Working principle and functioning of motor -Types of motor - Mixer - Juicer - Grinder - Electrical fan - Refrigeration System - Vacuum cleaner - Washing machine - UPS - Testing and repairs.	9	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
VI	**SELF-STUDY FOR ENRICHMENT** (Not included for End Semester Examinations) LED Principle and working - Working of smart Gadgets - Digital display - Safety precautions for using domestic appliances.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

Text Books

1. Eric Kleinert, (2013), *Troubleshooting and Repairing Major Appliances*, McGraw-Hill Education.3rd Edition
2. Murugeshan R, (2017), *Electricity and Magnetism*, S. Chand & Co. Publishing., Revised Edition.
3. Mehta V. K & Rohit Mehta, (2014), *Principles of Eelectronics*, S. Chand & Co.Publishing., Revised Edition.

Reference Books

1. Walter C Bosshart,(1995), *Printed Circuit Board*, McGraw-Hill .RevisedEdition.

Web References

1. The Basic Principles of Electricity | Anixter
2. Soldering & Desoldering Techniques | Sciencing
3. Basic Electronics Tutorials and Revision (electronics-tutorials.ws)
4. Transformer - Definition, Types, Working Principle, Diagram (byjus.com)
5. https://www.constellation.com/energy-101/electrical-safety-tips.html

Pedagogy

Chalk and Talk , Power Point Presentations, Seminars, Assignments and Quiz.

Course Designer

Dr. B. ANITHA