CAUVERY COLLEGE FOR WOMEN (AUTONOMOUS)

NATIONALLY ACCREDITED (IVCYCLE) WITH "A+" GRADE BY NAAC

TIRUCHIRAPPALLI–18

PG & RESEARCH DEPARTMENT OF PHYSICS

M.Sc., PHYSICS SYLLABUS

(2024-2025 and Onwards)

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

PG &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 post graduate 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 nurture the 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 multi-disciplinary 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
PO1	**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.
PO2	**Scientific Skills:** Create and apply advanced techniques and tools to Solve the societal environmental issues.
PO3	**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 of learners.
PO5	**Lifelong learning:** Instil critical thinking, communication, initiative which potentially leads to higher rates of employment and educational fulfillment.

PROGRAMME SPECIFIC OUTCOME FOR M.Sc., PHYSICS

PROGRAMME

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 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 OUTCOMES BASED CURRICULUM FRAMEWORK (CBCS – LOCF)
(For the Candidates admitted from the Academic year 2024-2025onwards)

Sem	Course	Title	Course Code	Ins. Hr Week	Credit	Exam Hrs	Marks		Total
							Int	Ext	
I	Core Course - I (CC)	Mathematical Physics	23PPH1CC1	6	5	3	25	75	100
	Core Course -II (CC)	Classical Mechanics and Relativity	23PPH1CC2	6	5	3	25	75	100
	Core Course - III (CC)	Linear and Digital ICs and Applications	23PPH1CC3	6	5	3	25	75	100
	Core Practical- I (CP)	General Physics and Electronics-I (P)	23PPH1CC1P	6	5	3	40	60	100
	Discipline Specific Elective Course-I (DSE)	Physics of Nano Science and Technology	23PPH1DSE1A	6	3	3	25	75	100
		Energy Physics	23PPH1DSE1B						
		Digital Communication	23PPH1DSE1C						
			Total	**30**	**23**	**-**	**-**	**-**	**500**
II	Core Course -IV (CC)	Electromagnetic Theory	22PPH2CC4	6	5	3	25	75	100
	Core Course -V (CC)	Quantum Mechanics	23PPH2CC5	6	5	3	25	75	100
	Core Choice Course - I (CCC)	Microprocessor and Microcontroller	23PPH2CCC1A	6	4	3	25	75	100
		Nonlinear Dynamics	22PPH2CCC1B						
		Physics of Sensor and Transducer	23PPH2CCC1C						
	Core Practical -II (CP)	Microprocessor and Python Programming (P)	22PPH2CC2P	6	5	3	40	60	100
	Discipline Specific Elective Course -II (DSE)	Numerical Methods and Python Programming	22PPH2DSE2A	6	3	3	25	75	100
		Biomechanics and Biophysics	23PPH2DSE2B						
		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	23PPH3CC7	5	4	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 – II (CP)	General Physics and Electronics-II (P)	22PPH3CC3P	6	5	3	40	60	100
	Discipline Specific Elective Course -III (DSE)	Problem Solving in Physics	23PPH3DSE3A	5	3	2	-	100	100
		Crystal Growth and Thin Film	22PPH3DSE3B			3	25	75	100
		Weather Forecasting	22PPH3DSE3C						
	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**	**23**	-	-	-	**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
		Plasma Physics	23PPH4CCC3B						
		Space Physics	22PPH4CCC3C						
	Core Practical - IV(CP)	Electronics (P)	23PPH4CC4P	6	5	3	40	60	100
	Generic Elective Course -II (GEC)	Troubleshooting and Repairing Domestic Appliances	22PPH4GEC2	3	2	3	25	75	100
	Project	Project Work	23PPH4PW	9	4	-	-	100	100
			TOTAL	**30**	**20**	-	-	-	**500**
			TOTAL	**120**	**90**	-	-	-	**2200**

Semester -I	Internal Marks: 25		External Marks: 75	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
23PPH1CC1	**MATHEMATICAL PHYSICS**	**CC-I**	**6**	**5**

Course Objectives

- To equip students with the mathematical techniques needed for understanding theoretical treatment in different courses taught in their program
- To extend their manipulative skills to apply mathematical techniques in their field.
- To help students apply Mathematics in solving problems of Physics
- To enhance problem solving skills and to give the ability to formulate, interpret and draw inferences 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
CO1	Remember and understand the various mathematical concepts used in physics.	K1,K2
CO2	Apply mathematical tools like vector, matrix, complex integration, Fourier and Laplace series, special function will prepare the student to solve ODE; PDE's which model physical phenomena.	K3
CO3	Analyse the vector, linear, simultaneous and differential equations which will be necessary to pursue other areas in physics.	K4
CO4	Evaluate the Laplace transform and the Fourier transformations of different function, grasp how these transformations can speed up analysis and correlate their importance in technology	K5
CO5	Solve the physical problems using mathematical techniques.	K6

Mapping of CO with PO and PSO

Cos	PSO1	PSO2	PSO3	PSO4	PSO5	PO1	PO2	PO3	PO4	PO5
CO1	3	2	2	2	1	3	3	2	2	2
CO2	3	2	1	2	1	3	1	2	2	2
CO3	3	2	1	2	1	3	3	1	2	2
CO4	3	1	3	2	1	1	3	2	2	2
CO5	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	**LINEAR VECTOR SPACE** Basic concepts – Definitions- examples of vector space –Linear independence - Scalar product- Orthogonality – Gram-Schmidt orthogonalization procedure –linear operators – Dual space- ket and bra notation – orthogonal basis – change of basis – Isomorphism of vector space – projection operator –Eigen values and Eigen functions – Direct sum and invariant subspace – orthogonal transformations and rotation	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**COMPLEX ANALYSIS** Review of Complex Numbers -de Moiré's theorem-Functions of a Complex Variable- Differentiability -Analytic functions- Harmonic Functions- Complex Integration- Contour Integration, Cauchy – Riemann conditions – Singular points – Cauchy's Integral Theorem and integral Formula -Taylor's Series - Laurent's Expansion- Zeros and poles – Residue theorem and its Application: Potential theory - (1) Electrostatic fields and complex potentials - Parallel plates - Heat problems - Parallel plates and coaxial cylinders	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**MATRICES** Types of Matrices and their properties, Rank of a Matrix - Conjugate of a matrix - Adjoint of a matrix - Inverse of a matrix - Hermitian and Unitary Matrices -Trace of a matrix- Transformation of matrices - Characteristic equation - Eigen values and Eigen vectors - Cayley–Hamilton theorem – Diagonalization	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**FOURIER TRANSFORMS & LAPLACE TRANSFORMS** Definitions -Fourier transform and its inverse - Transform of Gaussian function and Dirac delta function -Fourier transform of derivatives - Cosine and sine transforms - Convolution theorem. Application: Diffusion equation: Flow of heat in an infinite and in a semi - infinite medium - Laplace transform and its inverse - Transforms of derivatives and integrals – Differentiation and integration of transforms - Dirac delta functions - Application - Laplace equation: Potential problem in a semi - infinite strip	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	**DIFFERENTIAL EQUATIONS** Second order differential equation- Sturm-Liouville's theory - Series solution with simple examples - Hermite polynomials - Generating function - Orthogonality properties - Recurrence relations – Legendre polynomials - Generating function - Rodrigue formula – Orthogonality properties - Dirac delta function- One dimensional Green's function and Reciprocity theorem -Sturm-Liouville's type equation in one dimension &their Green's function.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

VI	**SELF-STUDY FOR ENRICHMENT** (Not included for End Semester Examinations) CurlVector in spherical polar coordinates. - harmonic function in complex Analysis - Sylvester's theorem- Laplace transforms in RLC Circuit - Bessel and Hankel functions.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. George Arfken and Hans J Weber, (2012), Mathematical Methods for Physicists – A Comprehensive Guide (7th edition), Academic press.
2. Chattopadhyay P K, (2013), *Mathematical Physics* (2nd edition), New Age, New Delhi
3. Joshi. A.W., (2017). *Matrices and Tensors in Physics*. (4th Edition) New Age, New Delhi.
4. Gupta.B. D., (2015). *Mathematical Physics*. (2nd Edition) Vikas Publishing House, Mumbai.
5. DassH.K., &Rama Verma., (2018). *Mathematical Physics* (1st Edition) S. Chand& Co, New Delhi.
6. Satya Prakash (2014). *Mathematical Physics* (1st Edition) Sultan Chand & sons, New Delhi.
7. Balakrishnan (2018). *Mathematical Physics with Applications*. Indian Academy of Science, Bangalore.

Reference Books

1. Kreyszig E, (1983), *Advanced Engineering Mathematics*, Wiley Eastern, New Delhi,
2. ZillD G and M. R. Cullen, (2006), *Advanced Engineering Mathematics*, 3rd Ed. Narosa, New Delhi.
3. Lipschutz S, (1987), *Linear Algebra, Schaum's Series*, McGraw - Hill, New York

   E. Butkov, 1968, Mathematical Physics Addison - Wesley, Reading, Massachusetts.
4. P. R. Halmos, (1965), *Finite Dimensional Vector Spaces*, Affiliated East West, New Delhi.2nd Edition.
5. C. R. Wylie and L. C. Barrett (1995), *Advanced Engineering Mathematics*, International Edition, McGraw-Hill, New York, 6 th Edition.

Web References

1. https://www.khanacademy.org/
2. https://www.youtube.com/watch?v=LZnRlOA1_2I
3. http://hyperphysics.phy-astr.gsu.edu/hbase/hmat.html#hmath
4. https://www.youtube.com/watch?v=_2jymuM7OUU&list=PLhkiT_RYTEU27vS_SlED56gNjVJGO2qaZ
5. https://archive.nptel.ac.in/courses/115/106/115106086/

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**
23PPH1CC2	**CLASSICAL MECHANICS AND RELATIVITY**	**CC-II**	**6**	**5**

Course Objective

- To understand fundamentals of classical mechanics.
- To remember Lagrangian formulation of mechanics and apply it to solve equation of motion.
- To understand Hamiltonian formulation of mechanics and apply it to solve equation of motion.
- To discuss the theory of small oscillations of a system.
- To learn the relativistic formulation of mechanics of a system.

Pre-requisites

- Fundamentals of mechanics,
- Foundation in mathematical methods.

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 fundamentals of classical mechanics.	K1
CO 2	Apply the principles of Lagrangian and Hamiltonian mechanics to solve the equations of motion of physical systems.	K2
CO 3	Apply the principles of Lagrangian and Hamiltonian mechanics to solve the equations of motion of physical systems.	K3 K5
CO 4	Analyze the small oscillations in systems and determine their normal modes of oscillations.	K4, K5
CO 5	Understand and apply the principles of relativistic kinematics to the mechanical systems.	K2, K3

Mapping of CO with PO and PSO

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
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	**PRINCIPLES OF CLASSICAL MECHANICS** Mechanics of a single particle – mechanics of a system of particles – conservation laws for a system of particles – constraints – holonomic& non-holonomic constraints – generalized coordinates – configuration space – transformation equations – principle of virtual work.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5,
II	**LAGRANGIAN FORMULATION** D'Alembert's principle – Lagrangian equations of motion for conservative systems – applications: (i) simple pendulum (ii) Atwood's machine (iii) projectile motion.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5,
III	**HAMILTONIANFORMULATION** Phase space – cyclic coordinates – conjugate momentum – Hamiltonian function – Hamilton's canonical equations of motion – applications: (i) simple pendulum (ii) one dimensional simple harmonic oscillator (iii) motion of particle in a central force field.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5,
IV	**SMALL OSCILLATIONS** Formulation of the problem – transformation to normal coordinates – frequencies of normal modes – linear triatomic molecule.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5,
V	**RELATIVITY** Inertial and non-inertial frames – Lorentz transformation equations – length contraction and time dilation – relativistic addition of velocities – Einstein's mass-energy relation – Minkowski's space – four vectors – position, velocity, momentum, acceleration and force in for vector notation and their transformations.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5,
VI	**SELF-STUDY FOR ENRICHMENT** (Not included for End Semester Examinations) Simple Applications of the Lagrangian Formulation - Canonical Transformations – Beyond Small Oscillations- The Damped Driven Pendulum and the Josephson Junction – Hamiltonian Formulation.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5,

Text Books

1. H. Goldstein, 2002, *Classical Mechanics*, 3rd Edition, Pearson Edu.
2. J. C. Upadhyaya, *Classical Mechanics*, Himalaya Publshing. Co. New Delhi.
3. R. Resnick, 1968, *Introduction to Special Theory of Relativity,* Wiley Eastern, New Delhi.
4. R. G. Takwala and P.S. Puranik, *Introduction to Classical Mechanics* –Tata – McGraw Hill,
5. New Delhi, 1980.
6. N. C. Rana and P.S. Joag, Classical Mechanics - Tata McGraw Hill, 2001.

Reference Books

1. K. R. Symon, 1971, *Mechanics,* Addison Wesley, London.
2. S. N. Biswas, 1999, *Classical Mechanics*, Books & Allied, Kolkata.
3. Gupta and Kumar, *Classical Mechanics*, KedarNath.
4. T.W.B. Kibble, *Classical Mechanics*, ELBS.
5. Greenwood, *Classical Dynamics*, PHI, New Delhi.

Web References

1. http://poincare.matf.bg.ac.rs/~zarkom/Book_Mechanics_Goldstein_Classical_Mechanics_optimized.pdf
2. https://pdfcoffee.com/classical-mechanics-j-c-upadhyay-2014-editionpdf-pdf-free.html
3. https://nptel.ac.in/courses/122/106/122106027/
4. https://ocw.mit.edu/courses/physics/8-09-classical-mechanics-iii-fall-2014/lecture-notes/
5. https://www.britannica.com/science/relativistic-mechanics

Pedagogy

Chalk and Talk, Power point presentation, Assignment, Group discussion and quiz

Course Designer

Dr. M. Kavimani

SEMESTER-I	INTERNALMARKS:25		EXTERNALMARKS:75	
COURSECODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
23PPH1CC3	LINEAR AND DIGITAL ICs AND APPLICATIONS	CC-III	6	5

Course Objective

- To understand the basic building blocks of linear integrated circuits.
- To teach the linear and non-linear applications of operational amplifiers.
- To remember the theory and applications of PLL.
- To introduce the concepts of waveform generation and introduce one special function ICs.
- To exposure to digital IC 's

Pre-requisites

- Knowledge of semiconductor devices
- Basic concepts of digital and analog electronics
- 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
CO1	Remember and understand the concepts of linear integrated circuits.	K1, K2
CO2	Analyze the linear and non-linear applications of operational amplifiers.	K3
CO3	Evaluate the basic concepts of operational amplifier, oscillator circuits and IC	K4
CO4	Apply the Principles and Concepts of waveform generation	K5
CO5	Recommend projects in electronics relevant to industrial and R &D needs	K5

Mapping of CO with PO and PSO

Cos	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO1	PO2	PO 3	PO4	PO5
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 the reisnocorrelation.**

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**INTEGRATED CIRCUITS AND OPERATIONAL AMPLIFIER** Introduction, Classification of IC's, basic information of Op-Amp 741 and its features, the ideal Operational amplifier, Op-Amp internal circuit and Op-Amp. Characteristics.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K5
II	**APPLICATIONS OF OP-AMP** INEAR APPLICATIONS OF OP-AMP: Solution to simultaneous equations and differential equations, Instrumentation amplifiers, V to I and I to V converters. **NON-LINEAR APPLICATIONS OF OP-AMP:** Sample and Hold circuit, Log and Antilog amplifier, multiplier and divider, Comparators, Schmitt trigger, Multivibrators, Triangular and Square waveform generators.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K5
III	**ACTIVE FILTERS &TIMER AND PHASE LOCKED LOOPS** ACTIVE FILTERS: Introduction, Butterworth filters – 1st order, 2nd order low pass and high pass filters, band pass, band reject and all pass filters. **TIMER AND PHASE LOCKED LOOPS**: Introduction to IC 555 timer, description of functional diagram, monostable and astable operations and applications, Schmitt trigger, PLL - introduction, Basic principle, phase detector/comparator, voltage-controlled oscillator (IC 566), low pass filter, monolithic PLL and applications of PLL	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K5
IV	VOLTAGE REGULATOR: Introduction, Series Op-Amp regulator, IC Voltage Regulators, IC 723 general purpose regulators, Switching Regulator. D to A AND A to D CONVERTERS: Introduction, basic DAC techniques -weighted resistor DAC, R-2R ladder DAC, inverted R-2R DAC, A to D converters - parallel comparator type ADC, counter type ADC, successive approximation ADC and dual slope ADC, DAC and ADC Specifications.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K5

V	**CMOS LOGIC, COMBINATIONAL CIRCUITS USING TTL 74XX ICs & SEQUENTIAL CIRCUITS USING TTL 74XX ICs** CMOS LOGIC: CMOS logic levels, MOS transistors, Basic CMOS Inverter, NAND and NOR gates, CMOS AND-OR-INVERT and OR-AND-INVERT gates, implementation of any function using CMOS logic. COMBINATIONAL CIRCUITS USING TTL 74XX ICs: Study of logic gates using 74XX ICs, Four-bit parallel adder (IC 7483), Comparator (IC 7485), Decoder (IC 74138, IC 74154), BCD to 7-segment decoder (IC7447), Encoder (IC74147), Multiplexer (IC74151), Demultiplexer (IC 74154). SEQUENTIAL CIRCUITS USING TTL 74XX ICs: Flip Flops (IC 7474, IC 7473), Shift Registers, Universal Shift Register (IC 74194), 4- bit asynchronous binary counter (IC 7493).	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K5
VI	**SELF- STUDY FOR ENRICHMENT:** (Not to be included for External Examination) Applications of operational Amplifier: inverting, non-inverting amplifier–adder, subtractor, differentiator–integrator. Applications of Multiplexer and Demultiplexer.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K5

Text Books

1. D. Roy Choudhury, Shail B. Jain (2012), *Linear Integrated Circuit*, 4th edition, New Age
2. International Pvt. Ltd., New Delhi, India
3. Ramakant A. Gayakwad, (2012), *OP-AMP and Linear Integrated Circuits*, 4th edition, Prentice
4. Hall, Pearson Education, New Delhi.
5. B.L. Theraja and A.K. Theraja, 2004, *A Textbook of Electrical technology*, S. Chand & Co.
6. V.K. Mehta and Rohit Mehta, 2008, *Principles of Electronics*, S. Chand & Co, 12th Edition.
7. V. Vijayendran, 2008, *Introduction to Integrated electronics (Digital & Analog)*, S. Viswanathan
8. Printers & Publishers Private Ltd, Reprint. V.

Reference Books

1. Sergio Franco (1997), *Design with operational amplifiers and analog integrated circuits*,
2. Mc Graw Hill, New Delhi.
3. Gray, Meyer (1995), *Analysis and Design of Analog Integrated Circuits,* Wiley International,
4. New Delhi.
5. Malvino and Leach (2005), *Digital Principles and Applications* 5th Edition, Tata McGraw
6. Hill, New Delhi
7. Floyd, Jain (2009), *Digital Fundamentals*, 8th edition, Pearson Education, New Delhi.
8. Millman & Halkias (2000) *Integrated Electronics*, Tata McGraw Hill, 17th Reprint.

Web References

1. https://nptel.ac.in/course.html/digital_circuits/
2. https://nptel.ac.in/course.html/electronics/operational_amplifier/
3. https://www.allaboutcircuits.com/textbook/semiconductors/chpt-7/field-effect-controlled-thyristors/
4. https://www.electrical4u.com/applications-of-op-amp/
5. https://www.geeksforgeeks.org/digital-electronics-logic-design-tutorials/

Pedagogy

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

Course Designer

Dr.K.Kannagi

Semester I	Internal Marks: 40			External Marks: 60
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
23PPH1CC1P	GENERAL PHYSICS AND ELECTRONICS - I (P)	CP-I	6	5

Course Objectives

- To acquire knowledge of spectrometry and to find optical constants
- To understand the concept of thermal behavior of the materials.
- Explain the operation about arithmetic and combinational logic circuits using IC's
- To acquire knowledge about combinational Logic circuits and sequential logic circuits
- To analyze the various parameters related to operational amplifiers.

Pre-requisites

Fundamental knowledge and hands on experience of general and electronics experiments of Physics

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	Explain the basic concepts of experimental physics.	K2
CO 2	Understand knowledge the principles of magnetism through the experiments	K2
CO 3	Explore the concepts of spectrometry involved in the optic processes.	K3
CO 4	Verify experimentally the concepts about combinational Logic circuits	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	2	2	1	2	1
CO 2	1	2	2	2	2	2	2	2	2	1
CO 3	1	2	2	2	2	2	2	2	1	1
CO 4	2	2	2	2	3	2	2	2	1	1
CO 5	2	2	2	2	3	2	2	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 TEN)

1. Determination of Rydberg's constant - Hydrogen Spectrum
2. Measurement of Band gap energy- Thermistor
3. Determination of Compressibility of a liquid using Ultrasonics
4. Determination of wavelength, separation of wavelengths - Michelson Interferometer
5. Measurement of Conductivity - Four probe method.
6. Construction of relaxation oscillator using UJT
7. FET CS amplifier- Frequency response, input impedance, output impedance
8. Study of important electrical characteristics of IC741
8. Study of attenuation characteristics of Wien's bridge network and design of Wein's bridge oscillator using Op- Amp
9. Study of attenuation characteristics of Phase shift network and design of Phase shift oscillator Using Op- Amp
11. Construction of Op-Amp- 4 bit Digital to Analog converter (Binary Weighted and R/2R ladder type)
12. Study of R-S, clocked R-S and D-Flip flop using NAND gates
13. Study of J-K, D and T flip flops using IC 7476/7473
14. Study of Arithmetic logic unit using IC 74181
15. Construction of Encoder and Decoder circuits using ICs.
16. Arc spectrum – Iron.

Text Book

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. S. Poornachandra *Electronic Laboratory Primer a design approach*, B. Sasikala, Wheeler Publishing, New Delhi.
4. *Electronic lab manual Vol I*, K A Navas, Rajath Publishing

Reference Book

1. Jones, B.K., (1986). *Electronics for Experimentation and Research*. Prentice-Hall.
2. Zbar, P.B., Malvino, A.P., & Miller, M.A., (1994). *Basic Electronics: A Text-Lab Manual. Tata Mc-Graw Hill*, New Delhi.
3. *Advanced Practical Physics*, S.P Singh, Pragati Prakasan.
4. *An advanced course in Practical Physics*, D. Chattopadhaya, C.R Rakshit, New Central Book Agency Pvt. Ltd
5. *Op-Amp and linear integrated circuit*, Ramakanth A Gaykwad, Eastern Economy Edition.

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**
23PPH1DSE1A	**PHYSICS OF NANOSCIENCE AND TECHNOLOGY**	**DSE-I**	**6**	**3**

Course Objectives

- To understand the material physics on the nano scale and the application aspects of nanoscience and technology
- To provide the basic knowledge about nanoscience and technology.
- To learn the structures and properties of nanomaterials.
- To acquire the knowledge about synthesis methods and characterization techniques and its applications.
- To understand the Technology with the characterization studyand applications at nanometer scale.

Pre-Requisites

- Basic knowledge in Solid State Physics.
- Physics of Nanoscience and Technology is concerned with the study, creation, manipulation and applications at nanometer scale.
- Understand the material physics on the nano scale.
- Understand the application aspects of nanoscience and technology.

Course Outcome

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 and explore the different types of nanomaterials and should comprehend the surface effects of the nanomaterials.	K1, K2
CO 2	To learn the structures and properties of nanomaterials.	K2
CO 3	Apply the process and mechanism of synthesis and fabrication of nanomaterials.	K3
CO 4	Analyze the various characterization of Nano-products through diffraction, spectroscopic, microscopic and other techniques.	K4
CO 5	Evaluate and apply the concepts of nanoscience and technology in the field of sensors, robotics, purification of air and water and in the energy devices.	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	**FUNDAMENTALS OF NANOSCIENCE AND TECHNOLOGY** Fundamentals of NANO–Historical Perspective on Nanomaterial and Nanotechnology-Classification of Nanomaterials–Metal and Semiconductor Nanomaterials- 2D, 1D, 0D nanostructured materials- Quantum dots– Quantum wires –Quantum wells-Surface effects of nanomaterials.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**PROPERTIES OF NANOMATERIALS** Physical properties of Nanomaterials: Melting points, specific heat capacity, and lattice constant - Mechanical behavior: Elastic properties – strength - ductility - superplastic behavior - Optical properties: - Surface Plasmon Resonance – Quantum size effects - Electrical properties - Conductivity, Ferroelectrics and dielectrics - Magnetic properties – super para magnetism – Diluted magnetic semiconductor (DMS).	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**SYNTHESIS AND FABRICATION** Physical vapour deposition - Chemical vapour deposition - sol-gel-Wet deposition techniques - electrochemical deposition method – Plasma arching - Electrospinning method - ball milling technique - pulsed laser deposition - Nanolithography: photolithography –Nanomanipulator.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**CHARACTERIZATION TECHNIQUES** Powder X-ray diffraction - X-ray photoelectron spectroscopy (XPS) - UV-visible spectroscopy – Photoluminescence - Scanning electron microscopy (SEM) - Transmission electron microscopy (TEM) - Scanning probe microscopy (SPM) - Scanning tunneling microscopy (STM) – Vibrating sample Magnetometer.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	**APPLICATIONS OF NANOMATERIALS** Sensors: Nano sensors based on optical and physical properties - Electrochemical sensors –Nano-biosensors. Nano Electronics: Nanobots - display screens - GMR read/write heads - Carbon Nanotube Emitters –Photocatalytic application: Air purification, water purification -Medicine: Imaging of cancer cells – biological tags - drug delivery - photodynamic therapy - Energy: fuel cells - rechargeable batteries -supercapacitors-photovoltaics.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	**SELF STUDY FOR ENRICHMENT** **(Not to be included for External Examination)** Nanomachines and Devices-Nanocomposites-Catalytic properties-Cytochemical synthesis along with suitable examples-Cyclic Voltammetry (CV)-Miscellaneous applications of nanotechnology-Dental implants, consumer products, biomimetic nanomaterials for tissue engineering, biopolymer tagging, semiconductor quantum dots.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Pradeep T, (2012), *A textbook of Nanoscience and Nanotechnology*, Tata McGraw-Hill Publishing.
2. Shah M A, Tokeer Ahmad (2010), *Principles of Nanoscience and Nanotechnology*, Narosa Publishing House Pvt Ltd.,
3. Chattopadhyay K K and Banerjee A N, (2012), *Introduction to Nanoscience and Nanotechnology*, PHI Learning Pvt. Ltd., New Delhi.
4. Hari Singh Nalwa, (2002), *Nanostructured Materials and Nanotechnology*, Academic Press.
5. Kothari D P, Velmurugan V and Rajit Ram Singh, (2018), *Nanotechnology and Nanoelectronics*, Narosa Publishing House Pvt. Ltd, New Delhi.
6. Poole C P and Ownes F J, (2003), *Introduction to Nanotechnology*, Wiley Reprint (2014).

Reference Books

1. Huozhong Gao, (2004), *Nanostructures and Nanomaterials*, Imperial College Press.
2. Richard Booker and Earl Boysen, (2005), *Nanotechnology*, Wiley Publishing Inc. USA
3. Fendler John Wiley and Sons. J H, (2007), *Nano particles and Nano structured films*; Preparation, Characterization and Applications.
4. Murty B S, et al., (2012), *Textbook of Nanoscience and Nanotechnology*, Universities Press.
5. Dr. Parag Diwan and Ashish Bharadwaj, (2005), *The Nanoscope*, Vol. IV-Nanoelectronics Pentagon Press, New Delhi.

Web References

1. www.its.caltec.edu/feyman/plenty.html
2. http://www.library.ualberta.ca/subject/nanoscience/guide/index.cfm
3. http://www.understandingnano.com
4. http://www.nano.gov
5. http://www.nanotechnology.com

Pedagogy

Chalk and Talk, Seminars on Industrial Interactions, Power Point Presentation, Quiz, Assignment and Group discussion.

Course Designer

Dr. R. Mekala

SEMESTER- I	INTERNAL MARKS: 25			EXTERNAL MARKS: 75
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
23PPH1DSE1B	**ENERGY PHYSICS**	**DSE-1B**	**6**	**3**

Course Objectives

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

Pre-requisites

- Knowledge of conventional energy resources.
- Basics of Tidal Energy and Bio gas Energy.
- Understandings of Wind Energy.
- Basic Idea on Solar Energy.

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	To identify various forms of renewable and non-renewable energy sources	**K1**
CO 2	Understand the principle of utilizing the oceanic energy and apply it for practical applications.	**K2**
CO 3	Discuss the working of a windmill and analyze the advantages of wind energy.	**K3**
CO 4	Distinguish aerobic digestion process from anaerobic digestion.	**K3,K4**
CO 5	Understand the components of solar radiation, their measurement and apply them to utilize solar energy.	**K2,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	1	2	2	3	3	2	2
CO 2	2	2	2	1	2	3	3	3	2	2
CO 3	2	2	2	1	2	3	3	3	2	2
CO 4	2	2	2	1	2	3	3	3	2	2
CO 5	2	2	2	1	2	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	**INTRODUCTION TO ENERGY SOURCES** Conventional and non-conventional energy sources and their availability–prospects of Renewable energy sources– Energy from other sources– chemical energy–Nuclear energy– Energy storage and distribution.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5.
II	**ENERGY FROM THE OCEANS** Energy utilization–Energy from tides–Basic principle of tidal power–utilization of tidal energy – Principle of ocean thermal energy conversion systems.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5.
III	**WIND ENERGY SOURCES** Basic principles of wind energy conversion–power in the wind–forces in the Blades– Wind energy conversion–Advantages and disadvantages of wind energy conversion systems (WECS) - Energy storage–Applications of wind energy.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5.
IV	**ENERGY FROM BIOMASS** Biomass conversion Technologies– wet and dry process– Photosynthesis -Biogas Generation: Introduction–basic process: Aerobic and anaerobic digestion – Advantages of anaerobic digestion– factors affecting bio digestion and generation of gas- bio gas from waste fuel– properties of biogas- utilization of biogas.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5.
V	**SOLAR ENERGY SOURCES** Solar radiation and its measurements–solar cells: Solar cells for direct conversion of solar energy to electric powers–solar cell parameter–solar cell electrical characteristics– Efficiency–solar water Heater –solar distillation– solar cooking–solar greenhouse – Solar Pond and its applications.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5.
VI	**SELF STUDY FOR ENRICHMENT** **(Not to be included for External Examination)** Thermo electric power – Small scale Hydro electrics – Inter connected systems-Alternative liquid fuels (Alcohol fuels)-Sun shine Recorder.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5,

Text Books

1. G.D. Rai, 1996, *Non – Conventional Energy sources,* 4th edition, Khanna publishers, New Delhi.
2. S. Rao and Dr. ParuLekar, *Energy technology.*
3. M.P. Agarwal, *Solar Energy,* S. Chand and Co., New Delhi (1983).
4. S. P. Sukhatme, *Solar energy, principles of thermal collection and storage*,2nd edition, Tata McGraw-Hill Publishing Co. Lt., New Delhi (1997).
5. S. Rao and Dr. Parulekar, *Energy Technology*

Reference Books

1. *Renewable energy resources*, John Twidell and Tonyweir, Taylor and Francis group, London and New York.
2. *Applied solar energy,* A. B. Meinel and A. P. Meinal
3. John Twidell and Tony Weir, *Renewable energy resources,* Taylor and Francis group, London and New York.
4. *Renewal Energy Technologies: A Practical Guide for Beginners* C.S. Solanki-PHI Learning
5. *Introduction to Non-Conventional Energy Resources* -Raja et. al., Sci. Tech Publications

Web References

1. https://www.open.edu/openlearn/ocw/mod/oucontent/view.php?id=2411&printable=1
2. https://www.nationalgeographic.org/encyclopedia/tidal-energy/
3. https://www.ge.com/renewableenergy/wind-energy/what-is-wind-energy
4. https://www.reenergyholdings.com/renewable-energy/what-is-biomass/
5. https://www.acciona.com/renewable-energy/solar-energy/

Pedagogy

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

Course Designer

Dr. T.Noorunnisha

Semester- I	Internal Marks: 25		External Marks: 75	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
23PPH1DSE1C	**DIGITAL COMMUNICATION**	**DSE-1C**	**6**	**3**

Course Objectives

- To understand the use of Fourier, transform in analyzing the signals
- To learn about the quanta of transmission of information
- To make students familiar with different types of pulse modulation
- To have an in-depth knowledge about the various methods of error controlling codes
- To acquire knowledge about spread spectrum techniques in getting secured communication

Pre-requisites

- Exposure to Fourier transform, multiplexing.
- Basics knowledge on Pulse Modulation.
- Understanding of coding.
- Knowledge on noises in communication signals.

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	Apply the techniques of Fourier transform, convolution and sampling theorems in signal processing	K1, K3
CO 2	Apply different information theories in the process of study of coding of information, storage and communication	K3
CO 3	Explain and compare the various methods of pulse modulation Techniques	K4
CO 4	Apply the error control coding techniques in detecting and correcting errors- able to discuss, analyze and compare the different error control coding	K3, K4
CO 5	Apply, discuss and compare the spread spectrum techniques for secure communications	K3, 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	3	2	3	1	2	3	3	2	1	3
CO 2	2	2	2	1	2	3	3	2	2	3
CO 3	3	3	2	1	2	2	2	2	1	2
CO 4	3	2	2	1	3	3	2	2	1	3
CO 5	2	2	2	1	3	3	2	2	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	**SIGNAL ANALYSIS** Fourier transforms of gate functions, delta functions at the origin – Two delta function and periodic delta function – Properties of Fourier transform – Frequency shifting – Time shifting - Convolution –Graphical representation – Convolution theorem – Time Convolution theorem – Frequency Convolution theorem –Sampling theorem.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5.
II	**INFORMATION THEORY** Communication system – Measurement of information - Coding – Bandot Code CCITT Code –Hartley Law – Noise in an information Carrying Channel- Effects of noise- Capacity of noise in a channel – Shannon Hartley theorem –Redundancy.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5.
III	**PULSE MODULATION** Pulse amplitude modulation - natural sampling – Instantaneous sampling - Transmission of PAM Signals - Pulse width modulation – Time division multiplexing – Band width requirements for PAM Signals. Pulse Code Modulation –Principles of PCM –Quantizing noise – Generation and demodulation of PCM -Effects of noise – Companding – Advantages and application.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5.
IV	**ERROR CONTROL CODING** Introduction to Linear Block Codes, Hamming Codes, BCH Coding, RS Coding, Convolutional Coding, Coding Grain Viterbi Coding.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5.
V	**SPREAD SPECTRUM SYSTEMS** Pseudo Noise sequences, generation and Correlation properties, direct sequence spread spectrum systems, frequency HOP Systems, processing gain, anti-jam and multipath performance.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5.
VI	**SELF STUDY FOR ENRICHMENT** **(Not to be included for External Examination)** Dual-Tone Multi frequency Signal Detection, Digital Filters, Multirate DSP, Linear Prediction &Optimum Linear Filters, Power spectrum estimation Bartlett and Welch methods	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5,

Text Books

1. B.P. Lathi, *Communication system*, Wiley Eastern.
2. George Kennedy, *Electronic Communication Systems,* 3rdEdition, McGraw Hill.
3. Simon Haykin, *Communication System*, 3rd Edition, John Wiley & Sons.
4. George Kennedy and Davis, 1988, *Electronic Communication System,* Tata McGraw Hill.
5. Taub and Schilling, 1991, *"Principles of Communication System"*, Tata McGraw Hill.

Reference Books

1. John Proakis, 1995, *Digital Communication*, 3rd Edition, McGraw Hill, Malaysia.
2. M. K. Simen, 1999, *Digital Communication Techniques, Signal Design and Detection*, Prentice Hall of India.
3. Dennis Roddy and Coolen, 1995, *Electronics communications,* Prentice Hall of India IV Edition.
4. Wave Tomasi, 1998, *"Advanced Electronics communication System"* Prentice Hall, Inc.
5. M.Kulkarni, 1988, *"Microwave and Radar Engineering",* Umesh Publications.

Web References

1. http://nptel.iitm.ac.in/
2. http://web.ewu.edu/
3. http://www.ece.umd.edu/class/enee630.F2012.html
4. http://www.aticourses.com/Advanced%20Topics%20in%20Digital%20Signals
5. http://nptel.iitm.ac.in/courses/117101051.html

Pedagogy

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

Course Designer

Dr. T. Noorunnisha

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 bystationary 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 of field equations, conservation laws and Gauge transformations

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	Evaluate electromagnetic wave equations in electro-magnetostatics	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	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
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 uniformelectric field - Laplace equation in rectangular coordinates.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
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, K1, K2, K3, K4, K5
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
V	**ELECTROMAGNETIC WAVES AND WAVE PROPAGATION** Electromagnetic waves in free space - 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 - Cavity resonator.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
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

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* 3rdeditionK.Nath &Co.,Meerut
3. Jordan . E.C. and K.G.Balmain,(2015), *Electromagnetic Waves and RadiatingSystems*,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/
4. https://www.sciencedirect.com/topics/computer-science/electromagnetic-theory
5. https://ocw.mit.edu/courses/8-311-electromagnetic-theory-spring-2004/

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**
23PPH2CC5	**QUANTUM MECHANICS**	**CC-V**	**6**	**5**

Course Objectives

- To provide the basic concepts of quantum mechanics and various formalism of quantum mechanics
- To impart knowledge of advanced quantum mechanics for solving relevant physical problems
- To introduce the role of Quantum Mechanics on evolution of the physical systems in our Universe
- To deepen the understanding of the theoretical and practical principles of Quantum Mechanics
- To familiarize students with advanced quantum mechanics

Pre-requisites

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

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	Analyze the advanced techniques in Physics to gain insights towards quantum mechanics	K1, K2
CO 2	Apply principles of Quantum Mechanics to calculate observables for given wave functions	K3
CO 3	Apply knowledge about fundamental quantum mechanical processes in Nature	K4
CO 4	Ascertain the mathematical concepts behind fundamentals of quantum mechanics.	K5
CO 5	Develop the concepts in quantum mechanics and apply the development of mathematical skills and problem solving in quantum mechanics	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	2	3	3	2	2	2	3
CO 2	3	2	3	3	2	3	2	2	2	2
CO 3	2	3	2	3	3	2	2	3	2	3
CO 4	3	3	3	2	3	3	3	3	2	2
CO 5	3	3	3	3	2	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	**SCHRÖDINGER EQUATION APPROACH** Time dependent Schrödinger equation - Time independent Schrödinger equation - Normalization and probability interpretation- Expectation values: Ehrenfest theorem - Conditions on the wave function **APPLICATIONS** Particle in a square well potential - Quantum mechanical tunnelling - Reflection at potential barrier and walls - Linear harmonic oscillator (Schrödinger method) - The free particle - Hydrogen atom - Deuteron	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**FORMALISM IN QUANTUM MECHANICS** Linear vector space - Linear operator - Eigenfunctions - Eigenvalues - Hermitian operator- Postulates of quantum mechanics - Simultaneous Measurability of Observables - General uncertainty Relation - Dirac's notation - Equation of motion - Momentum representation - Heisenberg Method - Matrix representation of Wavefunction - Matrix representation of operator - Schrodinger Equation in Matrix form- Unitary Transformations	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**SIMPLE HARMONIC OSCILLATOR** Harmonic oscillator in Schrodinger representation - Properties of stationery states - Formulation of Harmonic oscillator problem in abstract notation - Eigen states and Eigenvalues of the Harmonic oscillator (Abstract operator approach) - Creation, Annihilation and Number operators **ANGULAR MOMENTUM** Angular momentum operator - Commutations relations of Angular momentum - Eigenvalue and eigenfunction of L^2 and L_z - Eigenvalues of J^2 and J_z - Angular momentum matrices -Spin angular momentum - Addition of angular momentum- Clebsch Gordon Coefficients	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**TIME-INDEPENDENT PERTURBATION THEORY** Perturbation theory for discrete levels - Equation in various orders- non-degenerate levels -Degenerate levels - First excited state of Hydrogen atom - Two electron atoms-Variational method: Upper bound on ground state energy - Application to excited states Hydrogen molecule - WKB approximation: One	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

	dimensional Schrödinger equation with asymptotic solution **TIME-DEPENDENT PERTURBATION THEORY** Introduction - First order perturbation - Harmonic Perturbation -Transition to continuum states (Fermi'sGolden Rule) - Absorption and Emission of Radiation- Einstein's A and B coefficients - Selection Rule			
V	**SCATTERING THEORY** The Born approximation - Validity of Born approximation - Partial wave analysis: Asymptotic behavior of partial waves - Scattering amplitude in terms of phase shifts - Scattering by a square well potential- scattering by Coulomb potential **RELATIVISTIC QUANTUM MECHANICS** Generalization of the Schrodinger equation- Hydrogen like atom- The Klein - Gordon equation - Dirac Equation - Negative energy states - Spin of the Dirac particle - Spin Orbit Energy -The hydrogen Atom	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	**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 - Dirac's matrices	-	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 McGraw Hill, New Delhi.
2. Aruldhas G, (2009), *Quantum Mechanics*, Second edition, Prentice Hall of India.
3. Ghatak A & Lokanathan S (1987) *A Text Book of Quantum Mechanics*, Tata McGraw Hill, New Delhi
4. 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*, 4 th edition, Tata McGraw Hill, New Delhi,
3. Shankar R, (2007), *Principles of Quantum Mechanics*, 2 nd edition, Springer, New Delhi.
4. Thankappan V.K, (2014), *Quantum Mechanics*, 4th Edition Wiley Eastern Ltd, New Delhi.

Web References

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, Assignment, Group discussion and quiz

Course Designer

Dr.R.Meenakshi

SEMESTER-II	INTERNAL MARKS: 25		EXTERNAL MARKS: 75	
COURSECODE	**COURSE TITLE**	**CATEGORY**	**HRS / WEEK**	**CREDITS**
23PPH2CCC1A	**MICROPROCESSOR AND MICROCONTROLLER**	**CCC-I**	**6**	**4**

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
- Concepts 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/microcontroller 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 of microprocessor/microcontroller and interfacing devices	K4
CO 4	Distinguish the instruction set of microprocessor / micro controller and Create program with microprocessor/microcontroller	K5
CO 5	Develop programming skill using interfacing and peripheral devices of microprocessor/microcontroller	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
II	**MICROPROCESSOR PROGRAMING** Assembly language - Stacks - Subroutines. Simple programs: Addition and subtraction two 8-bit and 16-bit numbers – Shift an 8-bit number left by one bit- Mask off Least Significant 4 bits of an 8-bit number-Find the largest and smallest number in a data array– Sum of a series - Multiplication- Division - Multi-byte addition and subtraction.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**DATA TRANSFER SCHEMES AND 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) –Programmable Interrupt Controller (PIC 8259) – Special Purpose Interfacing Devices – Programmable CRT Controller (8275H) – Programmable Keyboard / Display Interface (8279)	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
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 – Conversion of 8 –bit number to BCD	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

V	**MICROPROCESSOR AND MICROCONTROLLER APPLICATIONS** Microprocessor Applications: Interfacing 7 segment LED display-Measurement of temperature-Microprocessor based traffic control. Microcontroller Applications: Temperature controller – Stepper motor.	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 offMost Significant 4 bits 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.8th Edition
2. Godse A. P Godse D.A. (2017) *Microprocessors and microcontrollers*. TechnicalPublications, Pune 4th Revised Edition

Reference Books

1. uhammad Ali Mazidi, Jinice Gillispie Mazidi (2004) *The 8051 microcontroller and embedded systems.* Pearson Education, Delhi.2nd Edition.
2. Nagoorkani A. (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.
3. https://kanchiuniv.ac.in/coursematerials/VIJAYARAGHAVAN_mp%20_mc

Pedagogy

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

Course Designer

Dr.T.Noorunnisha

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 introduce 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 ofChaos –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 – Conidial and solitary waves - The Scott Russel phenomenon and derivation of Korte Weg - 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 KdV equation–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 forExternal 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 NonlinearScience*, Springer.
5. Robert C. Hilborn. (2004). *Chaos and Nonlinear Dynamics*, 2nd Edition, India: OxfordUniversity 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**
23PPH2CCC1C	**PHYSICS OF SENSOR AND TRANSDUCER**	**CCC-I**	**6**	**4**

Course Objectives

- To acquire the knowledge of Sensing and transducer devices.
- To understand the structural and functional principles of sensors and transducers.
- To make familiar with the working of different types of sensors and transducers.
- To differentiate between the types of transducers available
- To gain information about the function of sensor and transducers.

Pre-requisites

- Fundamental knowledge of physical parameters.
- Basic idea 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 semiconductor sensors	K3
CO 3	Evaluate the working principles of sensor and transducers for measurement of displacement, strain, velocity, acceleration etc.	K4
CO 4	Apply the function of the sensor, transducer construction, principle of operation and characteristics in proper applications.	K5
CO 5	Determine the technologies in sensing and transducing devices.	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	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	COGNITIV ELEVEL
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
II	**SEMICONDUCTOR SENSOR** Introduction-Sensor Output Characteristics-Wheatstone's Bridge- Piezo resistivity in Silicon-Semiconductor Strain Gauges - Inductive Sensors: Sensitivity and Linearity of the Sensor –Types-Capacitive Sensors: Electrostatic Transducer - Force/Stress Sensors Using Quartz Resonators - Ultrasonic Sensors	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
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
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
V	**TEMPERATURE SENSORS AND THERMAL TRANSDUCERS** Heat and temperature, The bimetallic strip, Liquid and gas expansion, Thermocouples, Metal – resistance sensors, Thermistors, Radiant heat energy sensing, Pyroelectric detectors, Thermal transducers, Thermal to electrical transducers.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

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

Text Books

1. Patranabis. D, *Sensors and Transducers,* Wheeler publisher.
2. Randy Frank, (1995) *Understanding 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

Dr. K. KANNAGI

Semester -II	Internal marks: 40		External marks: 60	
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 of doing experiments in Programmed and formula skills.
- Develop the knowledge of 8085 Programme
- Formulate the idea of numerical problem in Python programing.

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 analyze 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, an 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	CONGNITIVE LEVEL
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 3/8rule -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 National Publishing 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: AGuide 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**
23PPH2DSE2B	**BIOMECHANICS AND BIOPHYSICS**	**DSE - II**	**6**	**3**

Course Objectives

- To give exposure and orientation of different aspects of biophysics
- To impart the knowledge about the links between physical and biological sciences
- To understand the applications of physics, chemistry to biological sciences
- To provide knowledge about bioenergetics.
- To gain keen understanding of Biomolecular mechanics.

Pre-requisites

- Strong foundation of biophysics
- Commendable Knowledge of macromolecular mechanics

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 Atomic & Molecular structures and thermodynamics	K1, K2
CO 2	Analyze the principles of physical sciences to understand and solve biological complexities	K3
CO 3	Recognize the biomechanics of human body.	K4
CO 4	Apply the concepts of dynamics to analysis the metabolism of human body.	K5
CO 5	Evaluate the intramolecular processes and interactions.	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	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	**ATOMIC & MOLECULAR STRUCTURES** Structure of Atom - Schrodinger's theory - Quantum numbers- Pauli's exclusion principle - Hund's rule - Bonds between atom & molecules – Ionic – Covalent – Hydrogen- Electrostatic – Disulphide & Peptide bonds - Vander Waals forces - Bond energies - Bond angles - Bayer's strain – Weak interactions	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5.
II	**THERMODYNAMICS & BIOENERGETICS** Laws of Thermodynamics - Concept of free energy- Unavailable energy & Entropy, change in entropy of living system - Heat content of food - Bomb calorimeter- Energy generation & energy transfer processes in biochemical reactions - Metabolism of glucose & formation of ATP - Energy requirements in cell metabolism - Role & Structure of mitochondria - High-energy phosphate bond.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5.
III	**MOLECULAR ALPHABETS OF LIFE** Amino acid - Nucleic acid bases & Lipids - Classification & Properties of Amino acid - Peptides & Polypeptides- Nucleosides - Nucleotides - Polynucleotides - Pentose & Hexose Polysaccharides - Amino acid to Peptides- Polypeptides.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5.
IV	**PRINCIPLES OF PROTEINS** Basics aspects of protein structure - Polypeptide chain geometrics - estimates of potential energy results of potential energy calculations - hydrogen bonding - hydrophobic & hydrophilic interactions and water as universal solvent in biological systems - Disruption of hydrophobic interactions by urea - ionic interactions - hydrophobic versus ionic interactions - prediction of protein structure.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5.
V	**MACROMOLECULAR MECHANICS** Ligand interaction at equilibrium - Identical independent sites - Scatchard plot - Multiple classes of independent sites - Interaction between binding sites – Allosterism- MWC model - Sequential model - Oxygen Hemoglobin binding - Binding of two different ligands - Energetics and dynamics of binding - Structures of protein - ligand Complexes	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5.

VI	**SELF STUDY FOR ENRICHMENT:** **(Not to be included for External Examination)** Molecular orbital theories, Hybridization of orbitals, σ and π bonds - Electron transfer phenomenon & biological energy transfer - Different types of linkages - Concept of protein evolution, Cytochrome & Hemoglobin evolutionary studies Free - radicals in biology and medicine.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5.

Text Books:

1. Ackerman E.A. Ellis, L.E.E. & Williams L.E. (1979), *Biophysical Science*, Prentice-Hall Inc.
2. Barrow. C. (1974), *Physical Chemistry for Life Sciences*, McGraw-Hill.
3. Berns M.W. (1982), *Cells*, Holt Sounders International Editors.
4. Bloomfield V.A. and Harrington R.E. (1975), *Biophysical chemistry*, W.A.Freeman and CO.
5. Bulter l.A.V. And Noble D.Eds. (1976), *Progress in Biophysics and Molecular Biology*, Oxford.
6. Cantor C.R. and Schimmel P.R. (1980), *Biophysical chemistry*, W.A.Fremman and Co.
7. Casey E.J. (1967), *Biophysics, concepts and mechanisms*, Affiliated East west press.

Reference Books:

1. Schule G.E. and schirmer R.H. (1984), *Principles of protein structure*, Springer-Verlag.
2. Segel F.H. (1975), *Enzyme Kinetics*, John willey and sons.
3. Setlow R.B. and pollard E.L. (1962), *Molecular Biophysics*, Pergamon Press.
4. Sheelk P. and Birch D.E. (1983), *Cell Biology Structure, Biochemistry and function*, John willey and sons.
5. Spragg S.E. (1980), *Physical Behavior of macromolecules with biological functions*, John willey and sons.

Web References

1. https://www.studocu.com/in/document/gujarattechnologicaluniversity/engineering-chemistry/engineering-chemistry-atomic-and- molecular-structure/20534347.
2. https://www.studocu.com/in/document/university-ofcalcutta/chemistry/chemical-thermodynamics-energetics-i-notes/27031492.
3. https://chem.libretexts.org/Bookshelves/BiologicalChemistry/ConceptsinBiophysicalChemistry(Tokmakoff)/02%3AMacromolecules/09%3AMacromolecularMechanics

Pedagogy

Lecture, Seminar, Assignments 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
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 theory of 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
23PPH3CC7	SOLID STATE PHYSICS	CC - VII	5	4

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 study the 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 – microwave and 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 mechanisms to ensure the protection of information technology assets.
- To expose students to governance, regulatory, legal, economic, environmental, social, and ethical contexts of cyber security.
- To expose students to the responsible use of online 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 responsibilities and 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 aspect s 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, Persona 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 and Vulnerabilities*.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 security controls for computer and implement technical security controls 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 security policies 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 sky and 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. Study of 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. Study the 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			EXTERNALMARKS :100	
COURSE CODE	**COURSETITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
23PPH3DSE3A	**PROBLEM SOLVING IN PHYSICS**	**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 of the physics for competitive examination.
- Learn the basic principles of Lattices.
- Understanding of the various application of Spectroscopy

Course Outcome and Cognitive Level Mapping

Onthe 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 Edition.

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

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 of the 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 of thin 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	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

	Spectroscopy - Elemental analysis – EDAX – SEM – TEM.			

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 study the 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 ofClimate Change | United Nations
3. ClimateChange 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 -III	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 structure and 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 of the 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	**CRYSTAL STRUCTURE AND CHEMICAL BONDS** 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 Diamond crystal 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	**NEWMATERIALS AND PHASETRANSFORMATION** 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. Raghavan .V (1993) *Material Science and Engineering* fifth edition Prentice Hall.
3. Hajra Choudhury. S.K. (1991) *Materials Science and Processes* 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
23PPH4CCC3B	PLASMA PHYSICS	CCC - III	6	4

Course Objectives

- To provide idea on Basic knowledge of Plasma.
- To learn the basic properties of Plasma.
- To understand the Motion of Charged Particle in Uniform Electromagnetic Field.
- To demonstrate the Motion of charged Particle in Constant Electromagnetic Field.
- To demonstrate the Motion of charged Particle in Non - Uniform Electromagnetic Field.
- To Acquire the knowledge in Applications of Plasma Physics

Pre-requisites

- Strong Foundation of different type of materials.
- Knowledge in kinetic theory.
- Commendable knowledge of classical and electromagnetic theory.

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 basic concepts of plasma.	K1, K2
CO 2	Analyze the properties in uniform and Non – uniform Electromagnetic field	K3
CO 3	Evaluate the motion of charged particles in uniform and Non – uniform magnetic field.	K4
CO 4	Apply the concept of classical physics, Electromagnetic theory in plasma	K5
CO 5	. Apply the plasma concept in magneto hydrodynamics.	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	2	3	3	3	3	2	3
CO 2	2	2	3	2	3	3	3	3	2	3
CO 3	2	2	3	2	3	3	3	3	2	3
CO 4	2	2	3	2	3	3	3	3	2	3
CO 5	2	2	3	2	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	**GENERAL PROPERTIES OF PLASMA:** Definition of a Plasma - Plasma as the Fourth State of Matter – Plasma Production Particle Interactions and Collective Effects - Some Basic Plasma Phenomena - Macroscopic Neutrality- Debye Shielding - The Plasma Frequency - The Occurrence of Plasmas in Nature	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**PLASMA PRODUCTION AND MEASUREMENTS:** Dc discharge method- - RF discharge Method - Photo-ionization method - Tunnel ionization method - Avalanche breakdown method - Laser produced plasmas method - Langmuir probe.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**WAVES AND INSTABILITIES:** Production of Electromagnetic waves, Langmuir wave, Ion acoustic wave, surface plasma wave, ionosphere propagation, two stream instability, Weibel instability.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**PLASMA CONFINEMENT :** Single particle motion in a magnetic field, motion in magnetic and electric fields, motion in inhomogeneous and curved magnetic fields, magnetic moment invariance, mirror confinement, tokamak confinement	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	**APPLICATIONS OF PLASMA PHYSICS:** Controlled Thermonuclear Fusion-The magnetohydrodynamic Generator- Plasma Propulsion - Other Plasma Devices –Parker Modified Momentum Equation - Medium and short wave communication- plasma processing of materials.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	**Self-Study for Enrichment** **(Not included for End Semester Examinations)** Freezing of Magnetic Field Lines to the Plasma - Magnetic Pressure - Isobaric Surfaces - Plasma Confinement in a Magnetic Field.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Bittencourt J. A.*" Fundamentals of Plasma Physics*", Third Edition Springer Press, New York
2. Hen F F, "*Introduction to Plasma Physics*", Springer Press, New York
3. Kelley Michael C, "*The Earth's Ionosphere: Plasma Physics and Electrodynamics*", Elsevier Inc.
4. John P I, *"Plasma Science and the Creation of Wealth",* Tata McGraw, India

Reference Books

1. Davidson R C, "Physics of Non-Neutral Plasmas", Allied Publishers Pvt. Ltd.
2. . Eliezer S and Eliezer Y, "The Fourth State of Matter: An Introduction to Plasma Science", 2nd Ed.CRC Press

Web References

1. https://www.psfc.mit.edu/vision/what_is_plasma#:~:text=Plasma%20is%20superheated%20matter%20%E 2%80%93%20so,the%20north%20and%20south%20poles.
2. https://www.techtarget.com/whatis/definition/plasma
3. https://www.nature.com/subjects/plasma-physics
4. https://www.colorado.edu/physics/research/plasma-physics
5. https://www.sciencedirect.com/topics/physics-and-astronomy/plasma-physics

Pedagogy

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

Pedagogy

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

Course Designer

Dr.S.Priya

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 every day 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 Learning Private Limited.
2. Baidyanath Basu., (2013) An Introduction to Astrophysics, PHI Learning Private Limited.

Reference books

1. Margaret G.Kivelson Christopher T. Russell, (1995), Introduction to Space Physics (2nd Edition), Cambridge University press, 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. Verification of De morgan's theorems and simplification of Boolean expression.
2. Construction of Counters using IC 7490.
3. Study of open loop differential gain using OP-AMP
4. Study of Multiplexer and Demultiplexer.
5. Study of Filters using OP-AMP
6. Study of Inverting Amplifier using OP-AMP.
7. Study of Non -Inverting Amplifier using OP-AMP.
8. Study of Shift Register using 7495.
9. Construction and Study of Monostable Multivibrator using OP-AMP.
10. Generation of waveforms using OP-AMP.
11. Construction and study of Half and Full Adder, Half and Full Subtractor using NAND and NOR gates.
12. Study of BCD to Seven Segment Display.
13. Study of the I-V Characteristics and efficiency of Solar cell.
14. 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.G.Maheswari

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 and function.
- 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 .Revised Edition.

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