CAUVERY COLLEGE FOR WOMEN (AUTONOMOUS) NATIONALLY ACCREDITED (IIICYCLE) WITH "A" GRADE BY NAAC ISO 9001:2015 Certified TIRUCHIRAPPALLI–18

PG & RESEARCH DEPARTMENT OF PHYSICS



M.Sc., PHYSICS SYLLABUS

(2023-2024 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 2023-2024onwards)

				Ins.		Exam	Marks		
Sem	Course	Title	Course Code	Hr Week	Credit	Hrs	Int	Ext	Total
	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
Ι	Core Practical- I (CP)	General Physics and Electronics-I(P)	23PPH1CC1P	6	5	3	40	60	100
	Discipline Specific Elective	Physics of Nano Science and Technology	23PPH1DSE1A	H1DSE1A					
	Course-I (DSE)	Energy Physics	23PPH1DSE1B	6	3	3	25	75	100
	· · ·	Digital Communication	23PPH1DSE1C						
	Total		30	23	-	-	-	500	
	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 –	Microprocessor and Microcontroller	23PPH2CCC1A						
	I(CCC)	Nonlinear Dynamics	22PPH2CCC1B	6	4	3	25	75	100
		Physics of Sensor and Transducer	23PPH2CCC1C						
	Core Practical -II (CP)	Microprocessor and Python Programming (P)	22PPH2CC2P	6	5	3	40	60	100
Π	Discipline Specific	Numerical Methods and Python	22PPH2DSE2A						
	Course -II (DS)	Biomechanics and Biophysics	23PPH2DSE2B	6	3	3	25	75	100
		Material Characterization and Measurement Techniques	22PPH2DSE2C						
	Internship	Internship	22PPH2INT	-	2	_	25	75	100
	Extra Credit Course	SWAYAM	As per UGC Reco	ommenda	tion				1
	TOTAL			30	24	-	-	-	600

	Core Course–	Statistical Mechanics	22PPH3CC6	6	5	3	25	75	100
	VI(CC) Core Course	Solid State Physics	23PPH3CC7	5	4	3	25	75	100
	-VII(CC)		2011110007	0		5		,0	100
	Core Choice Course–	Cyber Security	22PGCS3CCC2A	3T + 2P	4	3	25	75	100
	II(CCC)	Communication Electronics	22PPH3CCC2B	5					
		Physics of Semiconductor Devices	22PPH3CCC2C						
III	Core Practical - III(CP)	General Physics and Electronics-II (P)	22PPH3CC3P	6	5	3	40	60	100
	Discipline Specific Elective	Problem Solving in Physics	23PPH3DSE3A	5	3	2	-	100	100
	Course -III (DSE)	Crystal Growth and Thin Film Physics	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 Record	mmenda	tion				
	TOTAL			30	23	-	-	-	600
	Core course – VIII(CC)	Nuclear and Particle Physics	22PPH4CC8	6	5	3	25	75	100
	Core Choice Course -	Advanced Optics and Spectroscopy	22PPH4CCC3A	C		2	25		100
	III(CCC)	Plasma Physics	23PPH4CCC3B	0	4	3		15	100
	Core	Electronics (P)	22111400050						
	Practical - IV(CP)		22PPH4CC4P	6	5	3	40	60	100
IV	Generic Elective Course -II (GEC)	Troubleshooting and Repairing Domestic Appliances	22PPH4GEC2	3	2	3	25	75	100
	Project	Project Work	22PPH4PW	9	4	-	-	100	100
			TOTAL	30	20	-	-	-	500 2200
			IUIAL	140	90	-	-	-	<i>44</i> 00

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

- 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 understandthe 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.

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	LINEAR VECTOR SPACE	18	CO1.	K1.
	Basic concepts – Definitions- examples of vector space – Linear		CO2.	K2.
	independence - Scalar product- Orthogonality – Gram-Schmidt		CO3,	K3,
	orthogonalization procedure linear operators. Dualspace ket		CO4,	K4,
	and here notation _ orthogonal basis _ shange of basis		CO5	K5,
	Jacomembian of vector anone musication encreter. Eisen			K6
	- Isomorphism of vector space - projection operator -Eigen			
	values and Eigen functions – Direct sum and invariant subspace			
	- orthogonal transformations and rotation	10	001	771
11	COMPLEX ANALYSIS	18	COI,	KI,
	Review of Complex Numbers -de Moiré's theorem-Functions		CO2,	K2, K2
	of a Complex Variable- Differentiability -Analytic functions-		CO3,	КЗ, КЛ
	Harmonic Functions- Complex Integration- Contour		CO4, CO5	K4, K5
	Integration, Cauchy – Riemann conditions – Singular points –		005	K6
	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			
III	MATRICES	18	CO1,	K1,
	Types of Matrices and their properties, Rank of a Matrix -		CO2,	K2,
	Conjugate of a matrix - Adjoint of a matrix - Inverse of a matrix		CO3,	K3,
	- Hermitian and Unitary Matrices -Trace of a matrix-		CO4,	K4,
	Transformation of matrices - Characteristic equation - Eigen		CO5	K5,
	values and Eigen vectors - Cayley–Hamilton theorem –			K6
		10	GO 1	
IV	FOURIER TRANSFORMS & LAPLACE	18	COI,	KI, K2
			CO2,	K2, K2
	Definitions -Fourier transform and its inverse - Transform of		CO3,	КЗ, КЛ
	Gaussian function and Dirac delta function -Fourier transform		CO4, CO5	K4, K5
	of derivatives - Cosine and sine transforms - Convolution		005	K6
	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			
V	DIFFERENTIAL EQUATIONS	18	CO1,	K1,
	Second order differential equation- Sturm-Liouville's theory -		CO2,	K2,
	Series solution with simple examples - Hermite polynomials -		CO3,	K3,
	Generating function - Orthogonality properties - Recurrence		CO4,	K4,
	Relations – Legendre polynomials - Generating function -		CUS	KJ, K6
	function. One dimensional Green's function and Reciprocity			NU
	theorem -Sturm-Liouville's type equation in one dimension			
	&their Green's function.			

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

- 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.

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- 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.
- 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. <u>https://www.youtube.com/watch?v=LZnRlOA1_2I</u>
- 3. <u>http://hyperphysics.phy-astr.gsu.edu/hbase/hmat.html#hmath</u>
- 4. <u>https://www.youtube.com/watch?v=_2jymuM7OUU&list=PLhkiT_RYTEU27vS_SIED56gNjVJGO2qaZ</u>
- 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	Internal Marks: 25		
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
23PPH1CC2	CLASSICAL MECHANICS AND RELATIVITY	CC-II	6	5

- 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	Cognitive
	On the successful completion of the Course, the Student will be able to	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	K3
000	the equations of motion of physical systems.	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	K2, K3
	mechanical systems.	

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.

UNIT	CONTENT	HOURS	COs	COGNITIVE
				LEVEL
	PRINCIPLES OF CLASSICAL MECHANICS	18	CO1,	K1,
	Mechanics of a single particle – mechanics of a system		CO2,	K2,
I	of particles – conservation laws for a system of particles		CO3,	K3,
	- constraints - holonomic& non-holonomic constraints		CO4,	K4,
	– generalized coordinates – configuration space –		CO5	K5,
	transformation equations – principle of virtual work.			
	LAGRANGIAN FORMULATION	18	CO1,	K1,
TT	D'Alembert's principle – Lagrangian equations of		CO2,	K2,
11	motion for conservative systems – applications: (i)		CO3,	K3,
	simple pendulum (ii) Atwood's machine (iii) projectile		CO4,	K4, <i>V5</i>
	motion.		COS	мэ,
	HAMILTONIANFORMULATION	18	CO1.	K1.
	Phase space - cyclic coordinates - conjugate	10	CO2.	K2.
	momentum Hamiltonian function Hamilton's		CO3.	K3.
III	momentum – manntoman function – mannton's		CO4,	K4,
	canonical equations of motion – applications: (1) simple		CO5	K5,
	pendulum (11) one dimensional simple narmonic			
	oscillator (111) motion of particle in a central force field.			
		18	CO1,	K1,
	SMALL OSCILLATIONS		CO2,	K2,
IV	Formulation of the problem – transformation to normal		CO3,	K3,
	coordinates - frequencies of normal modes - linear		CO4,	K4,
	triatomic molecule.		CO5	K5,
		10	001	17.1
		18	CO1,	K1, K2
	NELAIIVIII Inertial and non-inertial frames I orentz		CO_2 , CO_3	K2, K3
	transformation equations length contraction and time		CO3,	КЗ, КЛ
V	dilation – relativistic addition of velocities – Finstein's		CO 4 , CO5	K4, K5
	mass-energy relation – Minkowski's space – four		005	110,
	vectors – position, velocity, momentum, acceleration			
	and force in for vector notation and their			
	transformations.			
			CO1,	K1,
	SELF-STUDY FOR ENRICHMENT	-	CO2,	K2,
VI	(Not included for End Semester Examinations)		CO3,	K3, K4
	Canonical Transformations Powerd Small		CO4, CO5	N4, K5
	Canonical Hansionnauons – Deyona Sinan Oscillations, The Damped Driven Dendulum and the		COS	NJ,
	Josephson Junction – Hamiltonian Formulation.			

- 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

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- 2. <u>https://pdfcoffee.com/classical-mechanics-j-c-upadhyay-2014-editionpdf-pdf-free.html</u>
- 3. <u>https://nptel.ac.in/courses/122/106/122106027/</u>
- 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:2	INTERNALMARKS:25		
COURSECODE	COURSE TITLE	CATEGORY	HRS/ WEEK	CREDITS
23PPH1CC3	LINEAR AND DIGITAL ICs AND APPLICATIONS	CC-III	6	5

- 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
C01	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.

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
п	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
ш	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 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

- 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
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- 2. Mc Graw Hill, New Delhi.
- 3. Gray, Meyer (1995), Analysis and Design of Analog Integrated Circuits, Wiley International,
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- 6. Hill, New Delhi
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- 1. https://nptel.ac.in/course.html/digital circuits/
- 2. <u>https://nptel.ac.in/course.html/electronics/operational amplifier/</u>
- 3. <u>https://www.allaboutcircuits.com/textbook/semiconductors/chpt-7/field-effect-controlled-thyristors/</u>
- 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 - L(P)	CP-I	6	5			

- 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	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

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. <u>https://www.studocu.com/in/document/reva-institute-of-technology-and-management/bachelors/MSc electronics-lab-student-copy/17586392</u>
- 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		

- 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

СО	CO Statement	Cognitive
Number	On the successful completion of the Course, the Student will be able to,	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.	К3
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

UNIT	CONTENT	HOURS	COs	COGNITIVE
T		10	001	
1	FUNDAMENTALS OF NANOSCIENCE AND	18	COI,	KI, K2
	TECHNOLOGY		CO2,	K2, K2
	Fundamentals of NANO-Historical Perspective on		CO3,	K3, K4
	Nanomaterial and Nanotechnology-Classification of		CO4, CO5	Κ4, <i>V5</i>
	Nanomaterials-Metal and Semiconductor Nanomaterials-		05	K5,
	2D, 1D, 0D nanostructured materials- Quantum dots-			Ко
	Quantum wires –Quantum wells-Surface effects of			
TT	nanomaterials.	10	001	17.1
11	PROPERTIES OF NANOMATERIALS	18	COI,	KI, K2
	Physical properties of Nanomaterials: Melting points,		CO2,	K2, K2
	specific near capacity, and lattice constant - Mechanical		CO3,	K3,
	benavior: Elastic properties – strength - ductility -		CO4,	K4,
	superplastic benavior - Optical properties: - Surface Plasmon		005	K5,
	Resonance – Quantum size effects - Electrical properties -			Кб
	Conductivity, Ferroelectrics and dielectrics - Magnetic			
	properties – super para magnetism – Diluted magnetic			
	semiconductor (DMS).	10	001	17.1
111	SYNTHESIS AND FABRICATION	18	COI,	KI, K2
	Physical vapour deposition - Chemical vapour deposition -		CO2,	K2,
	sol-gel-wet deposition techniques - electrochemical		CO3,	K3,
	deposition method – Plasma arching - Electrospinning		CO4,	K4,
	method - ball milling technique - pulsed laser deposition -		005	K5,
TX 7	Nanolitnography: photolitnography – Nanomanipulator.	10	001	KO
IV	CHARACTERIZATION TECHNIQUES	18	COI,	KI, K2
	Powder X-ray diffraction - X-ray photoelectron spectroscopy		CO2,	K2,
	(XPS) - UV-visible spectroscopy – Photoluminescence -		CO3,	K3,
	Scanning electron microscopy (SEM) - Iransmission		CO4,	K4,
	(SDM) Scamping tunneling microscopy (SDM) Vibrating		05	K5, <i>V6</i>
	(SPM) - Scanning tunneling microscopy (STM) – vibrating			Ко
X 7	sample Magnetometer.	10	001	IZ 1
V	APPLICATIONS OF NANOMATERIALS	18	COI,	KI, K2
	Sensors: Nano sensors based on optical and physical		CO2,	K2, K2
	properties - Electrochemical sensors – Nano-Diosensors. Nano		CO3,	K3, K4
	Electronics: Nanobols - display screens - GNR read/write		CO4, CO5	K4, <i>V5</i>
	neads - Carbon Nanotube Enniters —Photocatalytic		COS	KJ,
	Imaging of concer calls biological tags drug delivery			NO
	maging of cancer cens – biological tags - drug denvery -			
	bitteries superconsolitors photovoltaiss			
X/T	SELESTUDY FOD ENDICIMENT		CO1	V1
V I	SELF STUDY FOR ENRICHMENT	-	CO1,	KI, K2
	(Not to be included for External Examination)		CO_2	Κ2, V2
	Nanomachines andDevices-Nanocomposites-Catalytic		CO_{3}	кз, VA
	properties-Cytochemical synthesis along with suitable		CO4,	N4, V5
	examples-Cyclic Voltammetry (CV)-Miscellaneous		05	NJ, Ve
	applications of nanotechnology-Dental implants, consumer			N0
	products biomimetic nanomaterials for tissue angineering			
	bionolymentagoing comiconductor system data			
	biopolymer tagging, semiconductor quantum dots.			

- 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. <u>http://www.understandingnano.com</u>
- 4. <u>http://www.nano.gov</u>
- 5. <u>http://www.nanotechnology.com</u>

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		

- 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	CO Statement	Cognitive
Number	On the successful completion of the Course, the Student will be able to	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.	К3
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

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.
Π	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 andanaerobic digestion – Advantages of anaerobic digestion– factors affecting bio digestion andgeneration 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,

- 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).
- 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. <u>https://www.open.edu/openlearn/ocw/mod/oucontent/view.php?id=2411&printable=1</u>
- 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	

- 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

СО	CO Statement	Cognitive
Number	On the successful completion of the Course, the Student will be able to	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	К3
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

UNIT	CONTENT	HOURS	COs	COGNITIVE
				LEVEL
Ι	SIGNAL ANALYSIS	18	CO1,	K1,
	Fourier transforms of gate functions, delta functions at the		CO2,	K2,
	origin – Two delta function and periodic delta function –		СОЗ,	КЗ,
	Properties of Fourier transform – Frequency shifting –		CO4,	K4,
	Time shifting - Convolution –Graphical representation –		CO5	K5.
	Convolution theorem – Time Convolution theorem –			
	Frequency Convolution theorem –Sampling theorem.			
II	INFORMATION THEORY	18	CO1,	K1,
	Communication system – Measurement of information -		CO2,	K2,
	Coding – Bandot Code CCITT Code –Hartley Law –		CO3,	K3,
	Noise in an information Carrying Channel- Effects of		CO4,	K4,
	noise- Capacity of noise in a channel – Shannon Hartley		CO5	K5.
	theorem – Redundancy			
Ш	PULSE MODULATION	18	CO1	K1
	Pulse amplitude modulation - natural sampling –	10	CO1,	K1, K2
	Instantaneous sampling - Transmission of PAM Signals -		CO3	K3.
	Pulse width modulation Time division multiplaying		CO4.	K4.
	Pard width requirements for DAM Signals, Dulas Code		CO5	K5.
	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.			
IV	ERROR CONTROL CODING	18	CO1,	K1,
	Introduction to Linear Block Codes, Hamming Codes,		CO2,	K2,
	BCH Coding, RS Coding, Convolutional Coding, Coding		CO3,	K3,
	Grain Viterbi Coding		CO4,	K4,
X 7		10	CO5	K5.
V	SPREAD SPECTRUM SYSTEMS	18	CO1,	KI, K2
	properties direct sequences, generation and Correlation		CO2,	K^2, K^2
	frequency HOP Systems processing gain anti-jam and		CO3,	КЗ, КЛ
	multipath performance		CO4, CO5	K4, K5
VI	SFLE STUDY FOR ENRICHMENT		CO1	KJ.
T T	(Not to be included for External Examination)	_	CO1,	K2.
	Dual Tona Multi fraguency Signal Detection Digital		CO3.	K3,
	Dual-Tone Multimete DCD Linear Deschotion, 20 (CO4.	K4.
	Filters, Multirate DSP, Linear Prediction & Optimum		CO5	K5,
	Linear Filters, Power spectrum estimation Bartlett and			
	Welch methods			

- 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.

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- 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. <u>http://nptel.iitm.ac.in/</u>
- 2. <u>http://web.ewu.edu/</u>
- 3. <u>http://www.ece.umd.edu/class/enee630.F2012.html</u>
- 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 MARK	S: 25	EXTERNAL MARKS: 7		
COURSE CODE	COURSE TITLE	CATEGORY	HRS / WEEK	CREDITS	
22PPH2CC4	ELECTROMAGNETIC THEORY	CC-IV	6	5	

- 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 inElectrostatics	К3
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.

UNIT	CONTENT	HOURS	COs	COGNITIVE
UIII	CONTENT	noons	COS	LEVEL
	ELECTROSTATICS		CO1,	K1,
Ι	Coulomb's law - The electric field - Continuous charge		CO2,	K2,
	distributions - Field lines, Flux and Gauss's law and its	10	CO3,	КЗ,
	application - Field due to an infinite, straight, uniformly charged	18	CO4,	K4,
	wire - Multipole expansion of a charge distribution - The		CO5	K5
	Divergence of E - The curl of E - Electric potential - Poisson's and			
	Laplace Equation - Potential of a localized charge distribution -			
	Uniqueness theorems.			
	BOUNDARY VALUE PROBLEMS IN ELECTROSTATICS		CO1,	K1,
	Boundary conditions - Potential at a point between the plates of a		CO2,	K2,
	spherical capacitor - Potential at a point due to uniformly charged	10	CO3,	КЗ,
11	disc - Method of image charges - Point charge in the presence of a	18	CO4,	K4,
	grounded conducting sphere - Point charge in the presence of a		CO5	K5
	charged, insulated conducting sphere - Conducting sphere in a			
	uniform electric field - Laplace equation in rectangular coordinates.			
	MAGNETOSTATICS		CO1,	K1,
	The Lorentz Force Law - The Biot - Savart Law - The magnetic		CO2,	K1,
TTT	field of steady current - The Divergence and Curl of B -	10	CO3,	K2,
111	Applications of Ampere's Law - Magnetic scalar and vector	18	CO4,	КЗ,
	potentials - Magnetic dipole in a uniform field - Magnetization		CO5	K4,
	current - Magnetic intensity - Magnetic susceptibility and			K5
	permeability			
	FIELD EQUATIONS AND CONSERVATION LAWS		CO1,	K1,
	Ohm's law - Faraday's law - induced electric field - Inductance		CO2,	K2,
IV	Energy in magnetic fields - Maxwell's equations in free space and	18	CO3,	КЗ,
	linear isotropic media - Boundary conditions on fields at interface		CO4,	K4,
	continuity equations - Poynting's theorem - Potential formulation -		CO5	K5
	Lorentz and Coulomb Gauge transformations - retarded potentials.			
	ELECTROMAGNETIC WAVES AND WAVE		CO1,	K1,
	PROPAGATION		CO2,	K2,
T 7	Electromagnetic waves in free space - Propagation of		CO3,	КЗ,
v	electromagnetic waves in isotropic dielectrics and in		CO4,	K4,
	anisotropic dielectrics - Reflection and refraction of	18	CO5	K5
	electromagnetic waves: Kinematic and dynamic properties -			
	TM and TE modes - Propagation in rectangular waveguides -			
	Cavity resonator.			
	SELF STUDY FOR ENRICHMENT: (Not to be included for		CO1,	K1,
	External Examination)		CO2,	K2,
VI	Electrostatic Boundary conditions-boundary value problems on	_	СОЗ,	КЗ,
V I	spherical symmetry - Method of images - Magnetic potential from		CO4,	K4,
	uniform surface current of a long solenoid-Potential formulation -		CO5	K5
	Energy and momentum in EM waves			

- 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.

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- 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.

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- 1. https://bbsbec.edu.in/wp-content/uploads/2020/01/Question-Bank2.pdf
- 2. <u>https://studentsfocus.com/ee8391-et-question-papers-electromagnetic-theory-previous-year-question-papers-eee-3rd-sem/</u>
- 3. <u>https://learnengineering.in/ee8391-electromagnetic-theory/</u>
- 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 Mar						
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS			
23PPH2CC5	QUANTUM MECHANICS	CC-V	6	5			

- 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 ableto	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	К3
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 "3" – Substantial (High) Correlation "2" – Moderate (Medium) Correlation

"-" - indicates there is no correlation

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
Ш	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-INDEPENDENTPERTURBATIONTHEORYPerturbation 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

- 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, 2nd edition, Springer, New Delhi.
- 4. Thankappan V.K, (2014), *Quantum Mechanics*, 4th Edition Wiley Eastern Ltd, New Delhi.

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- 1. https://www.britannica.com/science/quantum-mechanics-physics
- 2. <u>https://plato.stanford.edu/entries/qm/</u>
- 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	EXTERNAL MARKS: 75		
COURSECODE	COURSE TITLE	CATEGORY	HRS / WEEK	CREDITS
23PPH2CCC1A	MICROPROCESSOR AND MICROCONTROLLER	CCC-I	6	4

- 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.

UNIT	CONTENT	HOURS	COs	CONGNITIVE LEVEL
Ι	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 bitsof 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 SynchronousAsynchronous 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 transferinstructions - 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
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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

- 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

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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.

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- 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	

- 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

СО	CO Statement	Cognitive
Number	On the successful completion of the Course, the Student will be able to	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.	К3
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

UNIT	CONTENT	HOURS	COs	COGNITIVE
	NON-LINEAR DYNAMICS			
	Dynamical systems-linear and nonlinear forces-			
	mathematical implications of nonlinearity–working		CO1,	K1,
Ι	definitions and effects of nonlinearity –damped and driven	1.0	CO2,	K2,
	nonlinear oscillators- autonomous and non-autonomous	18	CO3,	КЗ,
	systems – dynamical systems as coupled first – order		CO4,	K4,
	differential equations: equilibrium points – phase space/phase		CO5	K5,
	plane and phase trajectories – stability – attractors and repellers			K6
	- classification of equilibrium – points – limit cycle			
	motion – periodic attractor.			
	BIFURCATIONS AND CHAOS			V 1
	Bifurcation theory–Local and global bifurcations - Three		CO1,	K1, K2
т	dimensional autonomous systems and chaos, Lyapunov	10	CO2,	K2, K3.
11	exponents – Torus–quasi-periodic attractor – Poincaré map –	10	CO3,	K4,
	Period doubling cascades–Feigenbaum number-		CO4, CO5	K5,
	characterization-Homoclinic orbits, heteroclinic orbits-		005	K6
	Strange attractor and strange non-chaotic attractor.			
	DISCRETE DYNAMICS SYSTEMS,			
	SYNCHRONIZATION		CO1.	K1,
ттт	AND CONTROLLING OF CHAOS	10	CO2,	K2, K3
111	Linear and nonlinear discrete dynamics systems - complex	10	CO3,	К3, К4
	iterated maps-Logistic map-Linear stability-Period doubling		CO4,	K5,
	phenomena and chaos-Lyapunov exponents-Chaos		CO5	Kó
	synchronization- Synchronization manifold and stability			
	properties – Controlling of Chaos – applications.			
	FRACTALS, CELLULAR AUTOMATA AND		CO1	K1,
TT 7	PATTERN FORMATION	10	CO1, CO2.	K2,
IV	Dimension of regular and chaotic attractors – Fractals – Koch	18	CO3,	K3,
	curve Cantor set - Sierpinskiset-Julia and Mandelbrot sets-		CO4,	N4, K5
	Cellular automata-Self organized criticality-Stochastic		CO5	K5, K6
	resonance-pattern formation-Time series analysis			
	INTEGRABLE SYSTEMS AND SOLITONS			17.1
	Finite dimensional integrable systems - Linear and nonlinear		CO1	K1, K2
V	dispersive systems - Conidial and solitary waves - The Scott		CO1,	K2, K3
	Russel phenomenon and derivation of Korte Weg - de Vries	18	CO2, CO3.	K3, K4,
	(KdV) equation–Fermi–Pasta–Ulam (FPU) numerical		CO4,	K5,
	problem–FPU recurrence phenomenon – Numerical		CO5	K6
	experiments of Zabusky and Kruskal – Explicit soliton			
	solutions: one-two and N-soliton solutions of KdV equation-			
	Hirota's bilinear method.			

	SELF STUDY FOR ENRICHMENT	CO1,	K1,
VI	(Not to be included for External Examination)	CO2,	K2, K3
VI	Simple bifurcations- Chaos-Dynamics systems - Exercise and Problems.	CO3, CO4, CO5	K4, K5,

- 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

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- 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.
- Robert C. Hilborn. (2004). *Chaos and Nonlinear Dynamics*, 2nd Edition, India: OxfordUniversity press. Print.

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

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:				
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS		
23PPH2CCC1C	PHYSICS OF SENSOR AND TRANSDUCER	CCC-I	6	4		

- 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	CO statement	
Number	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.

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
П	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
ш	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

	SELFSTUDY FOR ENRICHMENT:	CO1,	K1,
	(Not to be included for External Examination)	CO2,	K2,
VI	Characteristics - Static characteristics - Dynamic -	СОЗ,	K3,
	characteristics Chemical / biological characterization -	CO4,	K4,
	Thermal Sensors Recent- Trends in Sensor Technologies	CO5	K5

- 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

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- 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.

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- 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

- 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

СО	CO Statement	Cognitive
Number	On the successful completion of the Course, the student will be	Level
	able to	
CO 1	Understand the basic operations of 8085	K2
CO 2	Applythe 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.

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. Studyof multibyte decimal subtraction
- 5. Studyof seven segment display
- 6. Studyof 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. <u>https://pythonnumericalmethods.berkeley.edu/notebooks/chapter21.03-Trapezoid-Rule.html</u>

Pedagogy

Demonstration and Practical sessions and viva voce

Course Designer

Dr. S. GOWRI

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

- 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, and Integration	K5, K6
CO 5	Develop programming skill in Boundary value problems and Eigen value problem, Interpolation, Differentiation, and Integration	K5, K6

Mapping of CO with PO and PSO

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

"1" – Slight (Low) Correlation,

"2"-Moderate (Medium) Correlation,

"3" – Substantial (High) Correlation,

"-" indicates there is no correlation.

UNIT	CONTENT	HOURS	COs	CONGNITIVE LEVEL
Ι	SOLUTION OF EQUATIONS AND EIGEN VALUE PROBLEMS Solution of algebraic and transcendental equations - Fixed point iteration method – Newton Raphson method-Solution of linear systemof 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
п	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	NUMERICALDIFFERENTIATIONANDINTEGRATIONApproximation of derivatives using interpolation polynomials-Numerical integration using Trapezoidal, Simpson's 1/3 rule - Simpson's 3/8rule -Taylor's series method–First order differential equation: Euler's method - Modified Euler'smethod - 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

- 1. Venkataraman M K, (1999), *Numerical Methods in Science and Engineering*, 5thEdition, 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. <u>https://www.youtube.com/watch?v=QqhSmdkqgjQ</u>
- 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 DesignerMs.

S. PRIYA

SEMESTER - II	INTERNAL MARKS:	EXTERNA	L MARKS: 75	
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
23PPH2DSE2B	BIOMECHANICS AND BIOPHYSICS	DSE - II	6	3

- 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.

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 - Weakinteractions	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5.
П	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.
ш	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 - hydroger 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 proteinstructure.	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.

	SELF STUDY FOR ENRICHMENT: (Not to be included for External Examination)		CO1,	K1,
VI	Molecular orbitaltheories, 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.	-	CO2, CO3, CO4, CO5	K2, K3, K4, K5.

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

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

- To illustrate the basic knowledge of optical microscope and image formation.
- To demonstrate X-raydiffractometer 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	CO Statement	Cognitive
Number	On the successful completion of the Course, the Student will be able to	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.	К3
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

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
Ι	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
П	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 - elementarytreatment 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

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

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	

- To understand the concepts of statistical thermodynamics
- To analyse the kinetic theoryand 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
C05	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.

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
Ι	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
Π	Classical Statistical Mechanics: Foundations of statistical mechanics - Specification of states of a system - Micro canonical ensemble - Phase space - Entropy - Connection between statistics and thermodynamics - Entropy of an ideal gas using the micro canonical ensemble - Entropy of mixing and Gibb's paradox.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
III	Methods of Ensembles: Partition Functions: Introduction- Micro Canonical Ensemble -Entropy in Statistical Mechanics- Perfect gas in microcanonical ensemble -Partition Functions- Partition Function and thermodynamical quantities - Entropy of a perfect gas (Gibb's Paradox) -Gibb's canonical ensemble – Perfect mono atomic gas in Canonical ensemble -Equipartition theorem – Grand canonical ensemble -Perfect gas in Grand canonical ensemble – Comparison various ensembles	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
IV	Quantum Statistical Mechanics: Basic postulates of quantum statistical mechanics - Microcanonical ensemble - Canonical ensemble - Grand canonical ensemble - Bose - Einstein and Fermi Dirac grand partition functions - Bose - Einstein distribution - Fermi Dirac distribution-Maxwell Boltzmann distribution - Bose - Einstein gas - Fermi gas - Bose - Einstein condensation.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5
V	Phase transition: Triple point -Vander Waal's Equation and Phase transition- First and second order phase transitions - Ehrenfest equations- Critical exponent - Ising model - one dimensional Ising model -Yang and Lee theory of phase transitions - Landau theoryof Phase transitions	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5

	Self-Study for Enrichment (Not included for End Semester Examinations)		CO1, CO2,	K1, K2,
VI	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.	-	CO3, CO4, CO5	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, 2ndedition, 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. <u>https://web.stanford.edu/~peastman/statmech/thermodynamics.html</u> 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	EX	FERNAL MARK	KS : 75
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
23PPH3CC7	SOLID STATE PHYSICS	CC - VII	5	4

- 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	К3
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 "3"- Substantial (High) Correlation **"2"-Moderate (Medium) Correlation "-"-indicates there is no correlation**

UNIT	CONTENT	HOURS	COs	COGNITIV ELEVEL
Ι	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
Π	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

	Self-Study for Enrichment		CO1,	K1,	
VI	(Not included for End Semester Examinations) Cubic zinc sulphide structure – CeF ₃ crystal structure – thermal conductivity of Quasi crystalline materials	-	CO2, CO3, CO4,	K2, K3, K4,	
	ferroelectric applications in memory devices – recent developments in bio magnetism – SQUID.		CO5	K5, K6	

- 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.

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- 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. <u>https://www.britannica.com/science/crystal</u>
- 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

- To develop skills in students that can help them plan, implement, and monitor cyber security mechanismsto ensure the protection of information technology assets.
- To expose students to governance, regulatory, legal, economic, environmental, social, and ethical contexts of cyber security.
- To expose students to theresponsible 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 securitythreat 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 securityrisks, plan suitable security controls	K4, k5

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

Theory:

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

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

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

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- 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. <u>https://www.csoonline.com/article/3444488/equifax-data-breach-faq-what-happened-who-was-affected-what-was-the-impact.html</u>
- 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 securitypolicies in the system.

Web References

- 1. <u>https://cybercrime.gov.in/</u>
- 2. https://cybercrime.gov.in/webform/crime_onlinesafetytips.aspx
- 3. https://www.digitalvidya.com/blog/social-media-dos-and-donts/
- 4. <u>https://www.medianama.com/2023/02/223-platform-grievance-appellate-committees-social-media/</u>
- 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

- 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 theoryand operation of satellite communication systems

Pre-requisites

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

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO 1	Recall and Understand the propagation of electromagnetic waves through skyand on earth's surface	K1, K2
CO 2	Applythe principle of radar in detecting locating, tracking, and recognizing objects of various kinds at considerable distances	К3
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"3" - Substantial (High) Correlation

"2" - Moderate (Medium) Correlation; "-" - indicates there is no correlation.

UNIT	CONTENT	HOURS	COs	COGNITIVE
				LEVEL
Ι	MODULATION AND MICROWAVES	15	CO1,	K1,
	Modulation: Theory of amplitude modulation – Frequency		CO2,	K2,
	modulation - Phase modulation-Noise - Internal noise-External		CO3,	K3,
	noise-noise calculation – noise figure-noise temperature.		CO4,	K4,
	Microwaves: Microwave generation—Multi cavity Klystron-		CO5	K5, <i>K6</i>
	reflex klystron-magnetron travelling wave tubes (TWT) and other			KU
	microwave tubes- MASER-Gunn diode-wave guides			
II	ANTENNAS AND TELEVISION	15	CO1,	K1,
	Antenna equivalent circuits-coordinate system-radiation fields -		CO2,	K2,
	Polarization- Power gain of Antenna-Hertzian dipole-Half wave		CO3,	K3,
	dipole-Vertical antenna-Loop ferrite rod antenna-non-resonant		CO4,	K4,
	antenna-driven array.		CO5	K5, <i>K6</i>
	Television : Colour TV transmission and reception-colour mixing			KU
	principle-colour picture tubes- Delta gun picture tube.			
III	RADAR AND SATELLITE COMMUNICATION	15	CO1,	K1.
	Elements of a radar system and its equation-Performance Factors -		CO2,	K2,
	radar transmitting systems-radar antennas- duplexers- radar		CO3,	КЗ,
	receivers and indicators		CO4,	K4,
	Satellite: Geo-stationary orbits - Power systems - Attitude control		CO5	К5,
	- satellite system link models_satellite system parameters			K6
	- satellite system link models-satellite system parameters			
IV	OPTICAL FIBER COMMUNICATION	15	CO1,	K1,
	Propagation of light in an optical fibre-acceptance angle- numerical		CO2,	K2,
	aperture-step and graded index fibres-optical fibres as a cylindrical		CO3,	K3,
	wave guide wave guide equations in step index fibres		CO4,	K4,
	fibre losses and dispersion applications		CO5	K5,
	- note tosses and dispersion-applications.			Ко
V	DISPLAY TYPES	15	CO1,	K1,
	Inorganic Phosphors- Cathode Ray Tubes (CRTs)- Vacuum		CO2,	K2,
	Eloroscont Displays, Filed Emission Displays Plasma Display		CO3,	K3,
	Panels I ED Displays Pried Emission Displays Plasma Display		CO4,	K4,
	Panels - LED Display Panels- morganic Electrorummescent		CO5	K5,
1 71	Displays		001	<u>K6</u>
VI	SELF-SIUDY FUK ENKICHMENI (Not included for End Semaster Exeminations)	-	CO1,	K1, V2
	(Not included for End Semester Examinations)		CO2	κ2, K3
	Signal Broadcasting Techniques- CCTV Principle- Synthetic		CO3,	K3, K4
	Aperture Radar(SAR)- Splicing techniques- Organic		CO4, CO5	K5.
	Electroluminescent Displays (OLEDs)		000	K6

- 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.
- 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.
- 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. <u>https://www.youtube.com/watch?v=3Tlx_t4D110</u>
- 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

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

- 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.	К3
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 04	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 "3"- Substantial (High) Correlation **"2"- Moderate (Medium) Correlation "-"- indicates there is no correlation**

UNIT	CONTENT	HOURS	COs	COGNITIVE
				LEVEL
Ι	ENERGY BANDS AND	10	CO1,	K1,
	CARRIERCONCENTRATION		CO2,	K2,
	Introduction to Semiconductor Devices-		CO3,	K3,
	Semiconductor Materials - Basic Crystal Structures -		CO4,	K4,
	Energy Bands - Intrinsic Carrier Concentration -		CO5	K5
	Donors and acceptors			
II	CHARGE TRANSPORT IN MATERIALS	15	CO1,	K1,
	Carrier Drift -Carrier Diffusion- Generation and		CO2,	K2,
	Recombination Processes -Continuity Equation -		CO3,	K3,
	Inermionic Emission Process - Tunnening Process -		CO4,	K4,
	Space-Charge Effect -High field effect		005	KO
III	P-NJUNCTION AND TRANSISTOR ACTION	17	CO1	K1.
	Thermal Equilibrium Condition -Depletion Region -	- /	CO2,	K2,
	Depletion Capacitance - Charge Storage and Transient		CO3,	КЗ,
	Behavior -Junction Breakdown – Hetero junction-		CO4.	K4,
,	Transistor Action - Static Characteristics of Bipolar		CO5	K5
	Transistors - Frequency Response and Switching of			
	Bipolar Transistor			
		1.5	001	17.1
IV .	MICKOWAVE DIODES; QUANIUM-EFFECI	15	COI,	KI, K2
-	AND HOT-ELECTRON DEVICES		CO2,	K2, K2
	Microwave Frequency Bands - Tunnel Diode -		CO3,	КЗ, КЛ
	- Transferred-Electron Devices - Quantum-Effect		CO4, CO5	K5
	Devices - Resonant Tunneling Diode - Hot- Electron		005	IX3
	Devices			
V	LIGHT EMITTING DIODES, LASERS AND	18	CO1,	K1,
	SOLAR CELLS		CO2,	K2,
	Radiative Transitions and Optical Absorption Light-		CO3,	КЗ,
	Emitting Diodes - Liquid crystal display- Plasma		CO4,	K4,
	display - Semiconductor Lasers - Photodetectors -		CO5	K5
	Solar Cells-Silicon and Compound- Semiconductor			
	Solar Cells - Third-Generation Solar			
	Cells - Optical Concentration			
VI	SELF-STUDY FOR ENRICHMENT	-	CO1,	K1,
	(Not included for End Semester Examinations) Energy		CO2,	K2,
	band gap for different materials - Electric current flow		CO3,	K3,
	devices Microward medium - Invristors and related power		CO4,	K4,
	applications - Applications of modern semiconducting		005	КS
	devices CCD OLED			
'				

- 1. Umesh K. Mishra, Jasprit Singh., (2008). "Semiconductor Device Physics and Design", Springer.
- 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.

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- 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	

- 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	CO Statement			
Number	On the successful completion of the course, students will be able to	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.			
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.			

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

"3" – Substantial (High) Correlation

"2" - Moderate (Medium) 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 rotatorypower of liquid using Polarimeter.
- 5. Four probe method-determination band gap energy of a semiconductor.
- 6. Determination of Planck Constant LED Method
- 7. Studyof Arithmetic Logic Unit.
- 8. Op-Amp 741 Solving Simultaneous Equations.
- 9. Voltage Controlled Oscillator Using IC 555.
- 10. Four bit binary Up and Down Counter using IC7476.
- 11. Differential amplifier using Op-Amp.
- 12. Simplification of Boolean expression by Karnaugh map.
- 13. Construction of Current to Voltage and Voltage to Current Conversion using IC 741.
- 14. Studythe functional groups of material using FTIR spectrometer.
- 15. Determine the Redox Potential of a material using Cyclic Voltammetry.

Text Books

- 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.
- Zbar, P.B., Malvino, A.P., & Miller, M.A., (1994). Basic Electronics: A Text-Lab Manual. Tata Mc-Graw Hill, New Delhi.

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- 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		

- 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

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

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

Mapping of CO with PO

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

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

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
	ELECTRONICS:	10	CO1,	K1,
Ι	Digital techniques and applications – Impedance matching-		CO2,	K2, K3
	amplification and noise reduction - Lock in detector -Box-		CO3, CO4,	K3, K4,
	Car integrator – Modulation techniques		CO5	K5
	CONDENSED MATTER PHYSICS :	20	CO1,	K1,
	Bravais lattices, Reciprocal lattice – Diffraction and the		CO2,	K2, K3
	structure factor – Bonding of solids – Elastic properties,		CO3, CO4,	K4,
	phonons, lattice specific hear – Free electron theory and		CO5	K5
	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.			
	MEASUREMENT METHODS	10	CO1,	K1,
III	Linear curve fitting - Nonlinear curve fitting - chi square		CO2,	K2,
	fitting – Transducers and its type - Particle detectors –		CO3, CO4.	К3, К4.
	Measurement systems.		CO5	K5
	ATOMIC PHYSICS	15	CO1,	K1,
	Quantum states of an electron in an atom. Electron spin.		CO2, CO3	K2, K3
IV	Spectrum of helium and alkali atom. Relativistic corrections		CO4,	K4,
	for energy levels of hydrogen atom, hyperfine structure and		CO5	K5
	isotopic shift, width of spectrum lines, LS & JJ couplings.			
	Zeeman, Paschen-Bach & Stark effects.			
	INFRARED & RAMAN SPECTROSCOPY	20	CO1,	K1,
	Vibrating diatomic molecule - Diatomic vibrating rotator -		CO2, CO3	K2, K3.
	Linear and symmetric top molecules - Pure rotational Raman		CO4,	K4,
17	spectra - Linear molecules - Symmetric top molecules -		CO5	K5
	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			

	SELF-STUDY FOR ENRICHMENT			
	(Not included for End Semester Examinations)			
VI	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

- 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, 4thEdition.
- 5. Aruldhas.G, *Molecular Structure and Spectroscopy*, Prentice Hall, 2006, 2ndEdition.
- 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, 3rdEdition.

Web Resources

- 1. https://pravegaa.com/free-study-material/
- 2. <u>https://testbook.com/csir-net/phys ical-science-study-material</u>
- 4. <u>https://careerendeavour.com/net-physics-study- materials/</u>
- 5. <u>https://www.googleadservices.com/pagead/aclk</u>?

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	DSE -III	5	3	
	THIN FILM PHYSICS				

- 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:

СО	CO statement	Knowledge
Number		Level
C01	Outline the basic knowledge of growth phenomena and discuss the theoretical aspects of nucleation , Growth, Structural and Application.	K1,K2
CO2	Applythe 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

"3" – Substantial (High) Correlation

"2" – Moderate (Medium) Correlation; "-" - indicates there is no correlation.

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
Ι	CRYSTAL GROWTH PHENOMENA:	15	CO1, CO2,	K1, K2,
	Nucleation - Homogeneous nucleation -Heterogeneous		CO3,	K3,
	nucleation - Formation of nucleation - spherical		CO4, CO5	K4, K5
	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.			
II	GROWTH OF SINGLE CRYSTAL:	15	CO1, CO2,	K1, K2,
	Solution Growth : Selection of solvents and solubility –		CO3,	K3,
	Meir's solubility diagram – Saturation and supersaturation		CO4, CO5	K4, K5
	- 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			
III	THIN FILM STRUCTURE:	15	CO1,	K1,
	Thin film growth stage – Deposition technique – physical		CO2, CO3.	К2, К3,
	method – Resistive heating – Electron beam gun – Laser		CO4,	K4,
	gun evaporation – Flash evaporation – Sputtering –		CO5	К5
	reactive sputtering - radio frequency sputtering -			
	chemical method – Electro deposition –Eletroless plating			
	– deposition by chemical reaction- Properties –			
	Dielectric property – Optical property.			
IV	STRUCTURAL ANALYSIS:	15	CO1,	K1,
	X-Ray diffraction studies (XRD) - Powder XRD equipment-		CO2, CO3,	к2, К3,
	Single XRD equipment -Examination of typical XRD		CO4,	K4,
	pattern. Fourier transform infrared Analysis (FTIR) - Raman		CO5	К5
	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,

- 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 filmfundamentals 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	/arks: 25		
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
22PPH3DSE3C	WEATHER FORECASTING	DSE - III	5	3

- 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 Statement	
	On the successful completion of the Course, the Student will be able	Cognitive
CO Number	to	Level
	Describe the basic concepts and physical parameters related to	K1, K2
CO 1	Atmosphere	
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 "3" – Substantial (High) Correlation "2" – Moderate (Medium) correlation "-" indicates there is no correlation

UNIT	CONTENT	HOURS	COs	COGNITIVE
I	INTRODUCTION TO ATMOSPHERE	17	CO1	LEVEL K1
1	Elementary idea of atmosphere: physical structure and	17	CO2,	K2,
	Elementary idea of autosphere, physical structure and		CO3,	K3,
	composition - Compositional layering of the atmosphere -		CO4, CO5	K4, K5
	Variation of pressure with height - Variation of pressure with air -		005	K6
	Atmospheric pressure: its measurement - Requirements to			
	measure air temperature - Temperature sensors: types - Cyclones			
	and anticyclones: its characteristics.			
II	INSTRUMENT AND MEASUREMENT OF WEATHER	16	CO1,	K1,
	Measurement of temperature: Thermometer - Measurement of		CO2,	K2, K3
	pressure: Mercury barometer- Measurement of humidity:		CO4,	K4,
	Hygrometer - Measurement of precipitation: Rain gauges -		CO5	K5,
	Measurement of wind velocity: Anemometer - Measurement of			KO
	clouds: Weather satellite.			
III	WEATHER SYSTEMS	13	CO1.	K1,
	Global wind systems and its components - Classification - Wind:		CO2,	K2,
	anad direction Thunderstorms Lat streams Tranical evaluates		CO3,	K3,
	speed, direction - Thunderstorms - Jet streams - Tropical cyclones -		CO4, CO5	к4, К5.
	Tornadoes - Hurricanes.		000	K6
IV	CLIMATE AND CLIMATE CHANGE	14	CO1,	K1,
	Climate: Classification of climate change - Causes of climate		CO2, CO3.	к2, К3,
	change - Global warming - Air pollution - Aerosols - Ozone		CO4,	K4,
	depletion - Acid rain - Environmental issues related to climate.		CO5	K5, K6
				KU
V	BASICS OF WEATHER FORECASTING	15	C01,	K1,
	Need of measuring weather - Types of weather forecasting -		CO2, CO3	K2, K3
	Weather forecasting methods - Criteria of choosing weather station		CO4,	K4,
	- Satellites observations in weather forecasting - Weather maps -		CO5	K5,
	Uncertainty and predictability - Probability forecasts.			Кб
VI	SELF-STUDY FOR ENRICHMENT	-	CO1,	K1,
	(Not included for End Semester Examinations)		CO2,	K2,
	Weather Forecasting Applications: Air traffic - Severe Weather		CO3, CO4	К3, К4
	Alerts - Marine - Agriculture - Military application		CO5	K5,
	Anto - Marine - Agriculture - Minitary application.			K6

- 1. I.C. Joshi, (2010). Aviation Meteorology. (3rd Edition), Himalayan Books, New Delhi.
- Nico le Mo lders & Gerhard Kramm, (2014). *Lectures in Meteorology*. (1^s edition) Springer International Publishing, Switzerland.
- 3. S.R. Ghadeker, (2001). *Meteorology*. Agromet Publishers, Nagpur.
- 4. Stephen Burt, (2012). The weather observers Hand book. (1s 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. <u>Meteorology- I.C.Joshi | sai ram Academia.edu</u>
- 2. Causes and Effects of Climate Change | United Nations
- 3. <u>Climate Change and Associated Issues INSIGHTSIAS (insightsonindia.com)</u>
- 4. Global warming Greenhouse Effect and Fossil Fuels | Britannica
- 5. <u>Weather forecasting Meteorology, Synoptic Weather Map, and International Meteorological Organization</u> <u>Britannica</u>

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	PH3GEC1 SCIENCE OF MATERIALS		3	2	

- 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:

СО	CO statement	Knowledge
Number		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

г.											
	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	HOUR	COs	COGNITIVE
T	CRVSTAL STRUCTUREANDCHEMICAL BONDS	5	CO1	
1	Introduction to crystals – Classification of crystal system –	,	CO1,	K1, K2,
	Introduction to Bravais lattice –I attice planes and Miller		CO3,	K3,
	indices – Interplanar spacing in a cubic lattice – Cubic lattice		CO4,	K4,
	-SC - BCC - ECC - Sodium chloride and Diamondervstal		CO5	K5
	structure Bonding of solids (Jonic Covalent Metallic			
	Hydrogen and Vander Waal)			
TT		0	<u> </u>	V 1
11	IECHNOLOGICAL PROPERTIES:	9	CO1,	K1, K2
	Introduction to material science – Classification of		CO2, CO3	K2, K3.
	engineering materials – Structure – Property relationships in		CO4,	K4,
	Weld shility. Mashing shility. Formahility. Costability		CO5	K5
	– weld admity–Machine admity–Formadinity– Castadinity.			
III	NEWMATERIALSANDPHASETRANSFORMATION	9	CO1.	K1,
	Metallic glass–Fiber reinforced materials– Metal matrix		CO2,	K2,
	composites–SAW materials–Biomaterials– Ceramics.		CO3,	КЗ,
	Nucleation and Growth - solidification - Allotropic		CO4,	K4,
	transformation- isothermal transformation – tensitic		005	КЭ
	transformation phase transformation in alloy steels.			
IV	MECHANICALPROPERTIESANDNON-	9	CO1,	K1,
	DESTRUCTIVETESTING:		CO2,	K2,
	Mechanical properties - Tensile – Fatigue – Creep – plastic		CO3,	K3,
	deformation mechanisms-methods of strengthening metals		CO4, CO5	K4, K5
	against yield – creep resistance – facture – fatigue failures		COS	KJ
	- 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			
V	MATERIALS FOR NUCLEAR AND SPACE	9	CO1,	K1, K2
, v	ALLECATIONS: Nuclear fuels - fuel cladding- moderators control materials		CO2, CO3	K2, K3.
	-Coolants - shielding materials - Space programme -		CO4,	K4,
	structural material and their properties - system requirements		CO5	K5
	- extreme high materials for thermal protection – pressure			
	vessels – Lubrication.			

VI	SELF-STUDY FOR ENRICHMENT	-	C01,	K1,
	 (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. 		CO2, CO3, CO4, CO5	K2, K3, K4, K5

TextBooks:

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

ReferenceBooks

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

Web references

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

Pedagogy

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

Course Designer:

Dr.S.PRIYA

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

- 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

СО	CO Statement	Cognitive
Number	On the successful completion of the Course, the Student will be	Level
	able to	
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

"3" – Substantial (High) Correlation

"2" - Moderate (Medium) Correlation

"-" – indicates there is no correlation

UNIT	CONTENT	HOURS	COs	COGNITIVE
	DASIC DDODEDTIES OF NUCLEUS			
Ι	BASIC PROPERTIES OF NOCLEUS 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
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- 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. <u>https://ocw.mit.edu/courses/8-701-introduction-to-nuclear-and-particle-physics-fall-2020/</u>
- 2. https://nptel.ac.in/courses/115103101
- 3. https://www.classcentral.com/course/swayam-nuclear-and-particle-physics-9873
- 4. <u>https://www.coursera.org/courses?query=nuclear</u>

Pedagogy

Chalk and Talk, Assignment, Group discussion and quiz

Course Designer

Dr.R.Gayathri

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

- 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	CO Statement	Cognitive
Number	On the successful completion of the Course, the Student will be able	Level
	to	
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.	К3
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

"3" – Substantial (High) Correlation

"2" - Moderate (Medium) Correlation

"-" – indicates there is no correlation

UNIT	CONTENT	HOURS	Cos	COGNITIVE
	THE NONLINEAD ODTICAL SUSCEDTIBILITY.			
Ι	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
Ш	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 ₂ O-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

- 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. <u>http://www.soest.hawaii.edu/HIGP/Faculty/sksharma/GG711/GG711Spectroscopy03Vibration</u> <u>al.pdf</u>
- 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. <u>http://jonsson.eu/research/lectures/lect8/web/</u>
- 5. <u>https://www.rp-photonics.com/frequency_doubling.html</u>

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 CODE COURSE TITLE		HRS/WEEK	CREDITS		
23РРН4ССС3В	PLASMA PHYSICS	CCC - III	6	4		

- To provide a 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	К3
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 "3" – Substantial (High) Correlation "2" – Moderate (Medium) Correlation; "-" indicates there is no correlation.

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
Ι	GENERALPROPERTIESOFPLASMA: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 ofPlasmas 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
ш	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 SemesterExaminations)Freezing of Magnetic Field Lines to the Plasma - MagneticPressure - Isobaric Surfaces - Plasma Confinement in aMagnetic Field.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

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

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: 2	25 H	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	Knowledge Level
	be able to	
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 everydaylife in the field of space weather.	К3
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
C01	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 "3" – Substantial (High) Correlation "2" – Moderate (Medium) Correlation "-" – indicates there is no correlation

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

Textbooks

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

Reference books

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

Web Resources

- 1. https://www.astrosen.unam.mx/~aceves/verano/libros/SpacePlasma.pdf
- 2. <u>https://www.youtube.com/watch?v=Ta_OEZTqB5w</u>
- 3. https://www.voutube.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		
22PPH4CC4P	ELECTRONICS (P)	CP-IV	6	5		

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

Mapping of CO with PO and PSO

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

"1" – Slight (Low) Correlation

"2" - Moderate (Medium) Correlation

"3" – Substantial (High) Correlation

"-" – indicates there is no correlation.

SYLLABUS

LIST OF EXPERIMENTS (Any 10)

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

Text Books

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

Reference Books

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

Web References

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

Pedagogy

Demonstration, practical sessions and viva voce

Course Designer

Dr.N.Manopradha

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

- 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

"3" - Substantial (High) Correlation

"2" - Moderate (Medium) correlation

"-" – indicates there is no correlation

UNIT	CONTENT	HOURS	COs	COGNITIVE
		-		LEVEL
I	ELECTRICITY	9	CO1,	K1,
	Electric Charge - Voltage - Electric Current - Ohm's		CO2,	K2,
	Law - Electric Potential - Types of wiring – ISI		CO3,	K3, V4
	Rules - Megger testing - Earthing - Serial Circuit -		CO4, CO5	K4, <i>V5</i>
	Parallel Circuit - Transformer - Working Principle -		COS	KJ
	Types (Phase, Core, Cooling).			
II	ELECTRICAL AND ELECTRONIC	9	CO1,	K1,
	COMPONENTS		CO2,	K2,
	Active and Passive Components: Resistors -Capacitors		CO3,	КЗ,
	- Fuses - Relays - Inductors - Semiconducting Devices:		CO4,	K4,
	Diodes - Types - Transistors		CO5	K5
	- Types - Integrated Circuits - Digital ICs for logic			
	gates - Comparison of electrical and electronic			
	device.			
ш	SOLDERING/DE-SOLDERING TECHNIQUES	9	CO1	K1.
	Principles of solder connections - Soldering Printed	-	CO2.	K2,
	Circuit Boards (PCB) - Types of Solder - Types of		CO3,	КЗ,
	PCB - Soldering flux - Soldering Irons - Flux		CO4,	K4,
	removal after soldering Do Soldering Hozards		CO5	K5
	involved in coldering - De - Soldering - Hazards			
	involved in soldering - Salety, health and medical			
** 7	aspects in soldering.	0	~~.	77.1
IV	FUNCTIONALITY OF ELECTRICAL	9	CO1,	KI, K2
	EQUIPMENT		CO2, CO2	K2, K3
	Main Components of a Tube Light - Solar powered		CO3,	КЗ, КЛ
	street lights - Water Heater - Iron box - Purifier - Air		CO4, CO5	K5
	Conditioner - Common occurring faults - Possible		005	110
	causes, testing and repairs.			
V	FUNCTIONALITY OF MOTOR APPLIANCES	9	CO1,	K1,
	Working principle and functioning of motor -Types		CO2,	K2,
	of motor - Mixer - Juicer - Grinder - Electrical fan -		CO3,	K3,
	Refrigeration System - Vacuum cleaner - Washing		CO4,	K4,
	machine - UPS - Testing and repairs.		CO5	K5
VI	SELF-STUDY FOR ENRICHMENT	-	CO1,	K1,
	(Not included for End Semester Examinations)		CO2,	K2,
	LED Principle and working - Working of smart		CO3,	K3,
	Gadgets - Digital display - Safety precautions for		CO4,	K4,
	using domestic appliances.		CO5	K5
	using usinostic uppriances.			

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

Reference Books

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

Web References

- 1. <u>The Basic Principles of Electricity | Anixter</u>
- 2. Soldering & Desoldering Techniques | Sciencing
- 3. <u>Basic Electronics Tutorials and Revision (electronics-tutorials.ws)</u>
- 4. <u>Transformer Definition, Types, Working Principle, Diagram (byjus.com)</u>
- 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