CAUVERY COLLEGE FOR WOMEN (AUTONOMOUS)

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

TIRUCHIRAPPALLI–18

PG & RESEARCH DEPARTMENT OF PHYSICS

M.Sc., PHYSICS SYLLABUS

(2026-2027 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

CHOICE-BASED CREDIT SYSTEM-LEARNING OUTCOME-BASED CURRICULUM FRAMEWORK (CBCS – LOCF)

(For the Candidates admitted from the Academic year 2026-2027 onwards)

Semester	Course	Course Title	Course Code	Inst. Hrs. / week	Credits	Exam			Total
						Hrs.	Marks		
							Int.	Ext.	
I	Core Course– I (CC-I)	Mathematical Physics	26PPH1CC1	6	5	3	30	70	100
	Core Course – II (CC-II)	Classical Mechanics and Relativity	26PPH1CC2	6	5	3	30	70	100
	Core Practical –I (CP-I)	General Physics -I (P)	26PPH1CP1	6	5	3	40	60	100
	Discipline Centric Elective Course-I (DCEC-I)	Physics of Nano Science and Technology	26PPH1DCE1A	5	3	3	30	70	100
		Energy Physics	26PPH1DCE1B						
		Biophysics	26PPH1DCE1C						
	Generic Elective Course -I (GEC-I)	Crystal Growth and Thin Film Physics	26PPH1GE1A	4	2	3	30	70	100
		Physics of Sensor and Transducer	26PPH1GE1B						
	Non-Major Elective Course -I (NMEC-I)	Troubleshooting and Repairing Domestic Appliances	26PPH1NME1	3	2	3	30	70	100
	Total			30	22				**600**
II	Core Course –III (CC-III)	Electromagnetic Theory	26PPH2CC3	6	5	3	30	70	100
	Core Course - IV (CC-IV)	Quantum Mechanics	26PPH2CC4	6	5	3	30	70	100
	Core Practical –II (CP-II)	Microprocessor and Python Programming(P)	26PPH2CP2	6	5	3	40	60	100
	Discipline Centric Elective Course- II (DCEC-II)	Microprocessor and Microcontroller	26PPH2DCE2A	5	3	3	30	70	100
		Plasma Physics	26PPH2DCE2B						
		Physics of Semiconductor Devices	26PPH2DCE2C						
	Generic Elective Course -II (GEC-II)	Numerical Methods and Python Programming	26PPH2GE2A	4	2	3	30	70	100
		Digital Communication	26PPH2GE2B						
	Non-Major Elective Course -II (NMEC-II)	Science of Materials	26PPH2NME2	3	2	3	30	70	100
	Extra Credit Course	SWAYAM	As per UGC Recommendation						
	Total			30	22				**600**
30 Days INTERNSHIP during Semester Holidays									

	Core Course- V (CC-V)	Solid State Physics	26PPH3CC5	6	5	3	30	70	100
	Core Course-VI (CC-VI)	Statistical Mechanics	26PPH3CC6	6	5	3	30	70	100
III	Core Practical -III (CP-III)	General Physics -II (P)	26PPH3CP3	6	5	3	40	60	100
	Discipline Centric Elective Course-III (DCEC-III)	Linear and Digital ICs and Applications	26PPH3DCE3A	5	3	3	30	70	100
		Medical Physics	26PPH3DCE3B						
		Sewage and Waste Water Treatment and Reuse	26PPH3DCE3C						
	Generic Elective Course -III (GEC-III)	Nonlinear Dynamics	26PPH3GE3A	3	2	3	30	70	100
		Weather Forecasting	26PPH3GE3B						
	Skill Enhancement Course -I(SEC-I)	Problem Solving in Physics	26PPH3SE1	4	2	2	-	-	100
	Internship	Internship	26PPH3INT	-	2	-	20	80	100
	Extra Credit Course	SWAYAM	As per UGC Recommendation						
	Total			30	24	-	-	-	**700**
IV	Core Course-VII (CC-VII)	Nuclear andParticle Physics	26PPH4CC7	6	5	3	30	70	100
	Core Practical- IV (CP-IV)	General Physics -III (P)	26PPH4CP4	6	5	3	40	60	100
	Discipline Centric Elective Course- IV (DCEC-IV)	Advanced Optics and Spectroscopy	26PPH4DCE4A	5	3	3	30	70	100
		Space Physics	26PPH4DCE4B						
		Solar Physics	26PPH4DCE4C						
	Generic Elective Course -IV (GEC- IV)	Fiber Optics and Applications	26PPH4GE4A	3	2	3	30	70	100
		Analytical Tools for Research	26PPH4GE4B						
	Skill Enhancement Course -II (SEC- II)	Arduino Programming (P)	26PPH4SEP2	3	2	3	40	60	100
	Entrepreneurship/Industry Based Course	Semiconductors for Smart Technologies (P)	26PPH4IBC	3	2	3	30	70	100
	Project	Project Work	26PPH4PW	4	4	-	-	100	100
	Total			30	23				**700**
	Grand Total			120	91				**2600**

Courses & Credits for PG Science Programmes

Sl. No	Courses	No of Courses	Hours Allocated	No of Credits	Marks
1.	Core Course – (CC)	7	6	7*5=35	700
2.	Core Practical – (CP)	4	6	4*5=20	400
3.	Discipline Specific Elective- (DSE)	4	5	4*3=12	400
4.	Generic Elective Course - (GEC)	4	3/4	4*2=8	400
5.	Non-Major Elective Course	2	3	2*2=4	200
5.	Skill Enhancement Course- (SEC)	2	3	2*2=4	200
6.	Project	1	4	4	100
7.	Internship	1	-	2	100
8.	Entrepreneurship/Industry Based Course	1	3	2	100
	Total	**26**		**91**	**2600**

Semester -I	Internal Marks: 30		External Marks: 70	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
26PPH1CC1	**MATHEMATICAL PHYSICS**	**CC - I**	**6**	**5**

Course Objectives

- To master vector integration, fundamental theorems and orthogonal curvilinear coordinates for analyzing physical fields.
- To apply complex variable techniques and residue theorem for evaluating definite integrals in physics.
- To solve special differential equations and enhance analytical problem-solving skills for mathematical modeling.

Pre-requisites

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

S. No.	Course Features	Relevance Status
1.	Course emphasis on Employability/Entrepreneurship/Skill Development	Employability, Skill Development
2.	Course integrates cross cutting issues relevant to Professional Ethics/Gender sensitization/ Environment and Sustainability/ Human Values/ Indian Knowledge System	Professional Ethics, Human Values
3.	Course relevant to Local/Regional/National/ Global needs	National and global need
4.	Course focus on Sustainable Developmental Goals	SDG 4, 8, 9

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO 1	Remember and Understand the various mathematical concepts used in physics.	K1, K2
CO 2	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
CO 3	Analyse the vector, linear, simultaneous and differential equations which will be necessary to pursue other areas in physics.	K4
CO 4	Evaluate the Laplace transform of different function, grasp how these transformations can speed up analysis and correlate their importance in technology	K5
CO 5	Solve the physical problems using mathematical techniques.	K6

Mapping of CO with PO and PSO

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

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

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**VECTOR ANALYSIS** Vector integration – Line integral – Surface integral – –Volume integral – Green's theorem – Stokes theorem – Divergence theorem – Orthogonal curvilinear coordinates – Unit vectors in curvilinear coordinate system – Gradient, divergence, curl and Laplacian in cylindrical and spherical polar coordinates.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**COMPLEX VARIABLES** Complex functions and variables – Condition for a function to be analytic – Complex integration – Cauchy's theorem – Taylor expansion – Laurent series – Cauchy's residue theorem – Computations of residue – Evaluation of integrals using residues.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**MATRICES** Types of Matrices and their properties, Rank of a Matrix -Conjugate of a matrix - Adjoint of a matrix - Inverse of a matrix - Hermitian and Unitary Matrices - Trace of a matrix- Transformation of matrices - Characteristic equation - Eigen values and Eigen vectors - Cayley–Hamilton theorem –Diagonalization	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**LAPLACE TRANSFORMS** Laplace transforms: Properties of Laplace Transforms – Convolution Theorem – Evaluation of Inverse Laplace Transforms– Evaluation of Laplace Transform using Differential Equations- Applications	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	**DIFFERENTIAL EQUATIONS** Solution of Differential Equations – Legendre and Hermite Differential Equations using Power Series method – Generating Function, Rodrigues Formula, Recurrence relation, Orthogonality relations.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	**SELF-STUDY FOR ENRICHMENT** (Not included for End Semester Examinations) Exact differential – Residue theorem and its Application -Sylvester's theorem- Simple applications of Laplace Transforms – Bessel and Laguerre differential equation using power series method	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Dass H.K., & RamaVerma., (2018).*Mathematical Physics*.(1st Edition) S.Chand & Co, New Delhi.
2. Gupta.B.D., (2015). *Mathematical Physics*. (2nd Edition)Vikas Publishing House, Mumbai.
3. Satya Prakash., (2014). *Mathematical Physics*.(1st Edition) Sultan chand & sons, Newdelhi.

Reference Books

1. Zill D G and M. R. Cullen, (2006), *Advanced Engineering Mathematics*, 3rd Ed. Narosa, New Delhi.
2. Lipschutz S, (1987), *Linear Algebra, Schaum's Series*, McGraw - Hill, New York 3. E. Butkov, 1968, Mathematical Physics Addison - Wesley, Reading, Massachusetts.
3. Kreyszig E, (1983), *Advanced Engineering Mathematics*, Wiley Eastern, New Delhi,

Web References

1. https://www.khanacademy.org/
2. https://www.youtube.com/watch?v=LZnRlOA1_2I
3. http://hyperphysics.phy-astr.gsu.edu/hbase/hmat.html#hmath

Pedagogy

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

Course Designer

Dr.R. Gayathri

Semester - I	Internal Marks: 30		External Marks: 70	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
26PPH1CC2	**CLASSICAL MECHANICS AND RELATIVITY**	**CC-II**	**6**	**5**

Course Objective

- To understand the fundamental principles of classical mechanics including conservation laws and generalized coordinates.
- To apply Lagrangian and Hamiltonian methods to derive equations of motion using variational principle.
- To analyze dynamical systems such as central force motion, oscillations, and rigid body motion.
- To evaluate small oscillations and rigid body dynamics using normal mode analysis and Euler's equations.
- To explain the basic concepts of special relativity including Lorentz transformations and relativistic dynamics.

Pre-requisites

- Knowledge of differential and integral calculus, differential equations, and basic linear algebra
- Understanding of vector algebra, vector calculus, and coordinate systems.
- Fundamental concepts of Newtonian mechanics including laws of motion, energy, momentum, and rotation.
- Basic understanding of oscillations and rigid body motion.
- Introductory knowledge of electromagnetism and special relativity concepts.

S. No.	Course Features	Relevance Status
1.	Course emphasis on Employability/Entrepreneurship/Skill Development	Employability, Entrepreneurship, Skill, Development
2.	Course integrates cross cutting issues relevant to Professional Ethics/Gender sensitization/ Environment and Sustainability/ Human Values/ Indian Knowledge System	Environment and Sustainability
3.	Course relevant to Local/Regional/National/ Global needs	Global need
4.	Course focus on Sustainable Developmental Goals	SDG 4,7,9, 11,12

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the Course, the Student will be able to	Cognitive Level
CO 1	Recall the fundamentals of classical mechanics and Relativity.	K1
CO 2	Explain the formulation of equations of motion using Lagrange's and Hamilton's methods, small oscillations theory, two-body problems, and special relativity principles.	K2
CO 3	Apply analytical mechanics methods to solve problems in oscillations, central force motion, rigid body dynamics, and relativistic systems.	K3
CO 4	Analyze mechanical and relativistic systems using variational principles, eigenvalue techniques, canonical equations, and four-vector formalism.	K4
CO 5	Evaluate and develop advanced dynamical models using classical and relativistic formulations of mechanics.	K5,K6

Mapping of CO with PO and PSO

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

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

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

Syllabus

UNIT	CONTENT	HOURS	Cos	COGNITIVE LEVEL
I	**FUNDAMENTAL PRINCIPLES AND LAGRANGIAN FORMULATION** Mechanics of a particle and system of particles– conservation laws – constraints – generalized coordinates – principle of virtual work – D'Alembert's principle –Lagrange's equations of motion for conservative system – applications on Lagrangian formulation: Atwood's machine – simple pendulum – compound pendulum- linear harmonic oscillator – Lagrange's equations in presence of non-conservative forces.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**TWO-BODY CENTRAL FORCE PROBLEM** Reduction of two-body central force problem to the equivalent one-body problem – Central Force and motion in a plane – Equations of motion under Central Force and first integrals – Differential equation for an orbit – Inverse square law of force– Kepler's laws of planetary motion and their deduction	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**HAMILTON'S FORMULATION** Hamiltonian – Hamilton's canonical equations of motion – physical significance of H-Cyclic coordinates – Hamilton's equations from variational principle – Applications on Hamilton's formulation: simple pendulum – compound pendulum – linear harmonic oscillator – particle in a central field of force –Δ-variation – principle of least action statement and its proof.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**SMALL OSCILLATIONS AND RIGID-BODY DYNAMICS** General theory of small oscillations – Equation of motion for small oscillations – solution of Eigen value equations –normal co-ordinates and normal frequencies of vibration –vibrations of a linear triatomic Molecule. Euler's angle – equation of motion of rigid body – Euler's equations – motion of a symmetric top under the action of gravity	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

V	**RELATIVITY** Inertial and non-inertial frames –Lorentz transformation equations – length contraction and time dilation – relativistic addition of velocities – Einstein's mass – energy relation – Minkowski's space – four vectors – position, velocity, momentum, acceleration and force in for vector notation and their transformations.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	**SELF-STUDY FOR ENRICHMENT** **(Not included for End Semester Examinations)** Lagrangian of a charged particle in the presence of electromagnetic field –The Laplace – Runge – Lenz vector free fall of a body on earth's surface – Foucault's pendulum – Lagrangian and Hamiltonian formulation of relativistic mechanics	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Upadhyaya, J. C. (2017). *Classical mechanics* (2nd Rev. Edition., reprint). Himalaya Publishing House, Mumbai, Maharashtra.
2. Goldstein, H., Poole, C. P., & Safko, J. L. (2002). *Classical mechanics* (3rd Edition.). Pearson Education, New Jersey, USA.
3. Resnick, R. (1968). *Introduction to special theory of relativity*. (1st Edition). Wiley Eastern, New Delhi.

Reference Books

1. Gupta, Kumar, & Sharma. (2012). *Classical mechanics* (27th Edition). Pragati Prakashan, Uttar Pradesh, India.
2. Rana, N. C., & Joag, P. S. (2001). *Classical mechanics*. (1st Edition). Tata McGraw-Hill, New Delhi.
3. Symon, K. R. (1971). *Mechanics* (3rd Edition.). Addison-Wesley, USA.

Web References

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

Pedagogy

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

Course Designer

Dr. A. Mary Girija

Semester - I	Internal Marks: 40			External Marks: 60
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
26PPH1CP1	**GENERAL PHYSICS - I (P)**	**CP-I**	**6**	**5**

Course Objectives

- To develop experimental skills in determining fundamental physical parameters such as elastic constants, Hall coefficient
- To explore the application of interference using interferometer.
- To understand and verify the operating principles of semiconductor devices, ultrasonic instruments, interferometers.
- To study the characteristics of liquids by different experimental methods.
- To enhance problem-solving and instrumentation skills by integrating theoretical knowledge with practical implementation.

S. No.	Course Features	Relevance Status
1.	Course emphasis on Employability/Entrepreneurship/Skill Development	Employability, Entrepreneurship, Skill, Development
2.	Course integrates cross cutting issues relevant to Professional Ethics/Gender sensitization/ Environment and Sustainability/ Human Values/ Indian Knowledge System	Environment and Sustainability
3.	Course relevant to Local/Regional/National/ Global needs	Global needs
4.	Course focus on Sustainable Developmental Goals	SDG 4,7,8,9,12

Pre-requisites

- Basic understanding of semiconductor physics and electrical measurements.
- Fundamental knowledge of optics and interference phenomena.
- Familiarity with material properties and fluid mechanics**.**

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the Course, the Student will be able to	Cognitive Level
CO 1	Understand the fundamental principles, instrumentation, and working mechanisms of optical, electrical, magnetic, and material characterization experiments.	K2
CO 2	Apply experimental techniques and standard laboratory procedures to determine various physical parameters.	K3
CO 3	Analyze experimental observations, interference patterns, spectra, and semiconductor characteristics to evaluate material properties.	K4
CO 4	Evaluate the accuracy, precision, limitations, and sources of error in experimental measurements using appropriate calculations, graphs, and interpretations.	K5
CO 5	Design and interpret experimental results through scientific reports, graphical analysis, and problem-solving approaches for advanced physics applications.	K6

Mapping of CO with PO and PSO

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

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

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

Syllabus

LIST OF EXPERIMENTS (ANY TEN)

1. Determination of Young's modulus and Poisson's ratio by Elliptical fringes - Cornu's Method.
2. Determination of Young's modulus and Poisson's ratio by Hyperbolic fringes - Cornu's Method.
3. Study of Hall effect in semiconductor.
4. Determination of compressibility of a liquid using Ultrasonic Interferometer.
5. Determination of wavelength, separation of wavelengths by Michelson Interferometer
6. Measurement of Conductivity by Four probe method.
7. Measurement of Coefficient of linear expansion by Air wedge Method.
8. Finding the thickness of mica sheet by Michelson Interferometer.
9. Determination of Planck Constant by LED Method
10. Estimation of Magnetic Susceptibility by Quincke's method.
11. Verification of Beer-Lambert's law by UV-visible spectroscopy.
12. Determination of Viscosity of the given liquid by Meyer's disc.
13. Determination of Rydberg's Constant by Hydrogen Spectrum.
14. Study the temperature characteristics and determine the band gap of given thermistor.
15. Determination of Refractive index of liquid-Newton's ring
16. Determination of Viscosity of the given liquid by Ostwald's Viscometer.

Text Book

1. Dr. Somasundaram S, (2012), Practical Physics (1st Edition), Apsara Publications, Chennai.
2. Singh, S. P. (2010). Advanced Practical Physics (Revised Edition), Pragati Prakasan, Meerut.
3. Ouseph C.C., Rao, U.J., & Vijayendran, V. (2009), Practical Physics and Electronics (Reprint Edition), S. Viswanathan, Printers & Publishers Pvt Ltd, Chennai.

Reference Book

1. Chattopadhyay, D., & Rakshit, C. R. (2012). An Advanced Course in Practical Physics (Revised Edition). New Central Book Agency Pvt. Ltd, Kolkata.
2. Zbar, P.B., Malvino, A.P., & Miller, M.A., (1994). Basic Electronics: A Text-Lab Manual (2nd Edition). Tata Mc-Graw Hill, New Delhi.
3. Jones, B.K., (1986). Electronics for Experimentation and Research (1st Edition). Prentice-Hall, New Delhi.

Web References

1. https://www.msuniv.ac.in/Download/Pdf/b2efcbdbc4be452
2. https://www.studocu.com/in/document/reva-institute-of-technology-and-management/bachelors/MSc electronics-lab-student-copy/17586392
3. https://www.vlab.co.in/broad-area-physical-sciences
4. https://onlinecourses.nptel.ac.in/noc20_ee13/preview

Pedagogy

Demonstration, Practical Sessions and Viva Voce

Course Designer

Dr. D.Devi

SEMESTER- I	INTERNAL MARKS: 30			EXTERNAL MARKS: 70
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
26PPH1DCE1A	**PHYSICS OF NANOSCIENCE AND TECHNOLOGY**	**DCEC-I**	**5**	**3**

Course Objectives

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

S. No.	Course Features	Relevance Status
1.	Course emphasis on Employability/Entrepreneurship/Skill Development	Employability, Skill Development
2.	Course integrates cross cutting issues relevant to Professional Ethics/Gender sensitization/ Environment and Sustainability/ Human Values/ Indian Knowledge System	Professional Ethics, Human Values
3.	Course relevant to Local/Regional/National/ Global needs	National and global need
4.	Course focus on Sustainable Developmental Goals	SDG 3,4,6,7, 9,12

Course Outcome

CO Number	CO Statement On the successful completion of the Course, the Student will be able to,	Cognitive Level
CO 1	Understand the basic of nanoscience and explore the different types of nanomaterials and should comprehend the surface effects of the nanomaterials.	K1, K2
CO 2	To learn the structures and properties of nanomaterials.	K2, K3
CO 3	Apply the process and mechanism of synthesis and fabrication of nanomaterials.	K3,K4
CO 4	Analyze the various characterization of Nano-products through diffraction, spectroscopic, microscopic and other techniques.	K4,K5
CO 5	Evaluate and apply the concepts of nanoscience and technology in the field of sensors, robotics, purification of air and water and in the energy devices.	K5, K6

Mapping of CO with PO and PSO

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

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

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

Syllabus

UNIT	CONTENT	HOURS		COGNITIVE LEVEL
I	**FUNDAMENTALS OF NANOSCIENCE AND TECHNOLOGY** Fundamentals of NANO–Historical Perspective on Nanomaterial and Nanotechnology-Classification of Nanomaterials–Metal and Semiconductor Nanomaterials- 2D, 1D, 0D nanostructured materials- Quantum dots– Quantum wires –Quantum wells-Surface effects of nanomaterials.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**SYNTHESIS AND FABRICATION** **Chemical Methods :** Sol – gel process– Self-assembly process – Electrodeposition – Spray pyrolysis– Flame pyrolysis– Metal nanocrystals by reduction– Solvothermal synthesis– Photochemical synthesis– Sonochemical Synthesis–Reverse micelles and microemulsions– Combustion method–Template process– Chemical vapor deposition(CVD)–Metal organic chemical vapor deposition(MOCVD).	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**SYNTHESIS AND FABRICATION** **Physical Methods :** Ball milling – Inert gas condensation technique(IGCT)–Thermal evaporation–Pulsed laser deposition(PLD)–DC/RF magnetron sputtering – Molecular beam epitaxy (MBE)–Melt spinning process –IC Fabrication process– Microlithography– Etching – Wet cleaning– CMP– Backend process – Atomic layer deposition (ALD)	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**PROPERTIES OF NANOMATERIALS** Physical properties of Nanomaterial's: Melting points, specific heat capacity, and lattice constant – Mechanical behavior: Elastic properties - strength – ductility - superplastic behavior - Optical properties: - Surface Plasmon Resonance – Quantum size effects - Electrical properties - Conductivity, Ferroelectrics and dielectrics – Magnetic properties – super para magnetism – Diluted magnetic semiconductor (DMS).	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

V	**APPLICATIONS OF NANOMATERIALS** Sensors: Nano sensors based on optical and physical properties - Electrochemical sensors –Nano-biosensors. Nano Carbon Nanotube Emitters– Photocatalytic application: Air purification, water purification -Medicine: Imaging of cancer cells – biological tags - drug delivery -photodynamic therapy - Energy: fuel cells – rechargeable batteries –supercapacitors - photovoltaics.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	**SELF STUDY FOR ENRICHMENT** **(Not to be included for External Examination)** Nanomachines and Devices-Nanocomposites-Catalytic properties-Cytochemical synthesis along with suitable examples-Cyclic Voltammetry (CV)- Dental implants, consumer products, biomimetic nanomaterials for tissue engineering, biopolymer tagging, semiconductor quantum dots.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. Pradeep T, (2012), *A textbook of Nanoscience and Nanotechnology*, Tata McGraw-Hill Publishing.
2. Chattopadhyay K K and Banerjee A N, (2012), *Introduction to Nanoscience and Nanotechnology*, PHI Learning Pvt. Ltd., New Delhi.
3. Shah M A, Tokeer Ahmad (2010), *Principles of Nanoscience and Nanotechnology*, Narosa Publishing House Pvt Ltd.,

Reference Books

1. Richard Booker and Earl Boysen, (2005), *Nanotechnology*, Wiley Publishing Inc. USA
2. Huozhong Gao, (2004), *Nanostructures and Nanomaterials*, Imperial College Press.
3. Dr. Parag Diwan and Ashish Bharadwaj, (2005), *The Nanoscope*, Vol. IV-Nanoelectronics Pentagon Press, New Delhi.

Web References

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

Pedagogy

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

Course Designer

Dr. S. Priya

SEMESTER- I	INTERNAL MARKS: 30			EXTERNAL MARKS: 70
COURSE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
26PPH1DCE1B	ENERGY PHYSICS	DCEC-1	5	3

Course Objective

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

Pre-requisites

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

S. No.	Course Features	Relevance Status
1.	Course emphasis on Employability/Entrepreneurship/Skill Development	Employability, Skill Development
2.	Course integrates cross cutting issues relevant to Professional Ethics/Gender sensitization/ Environment and Sustainability/ Human Values/Indian Knowledge System	Professional Ethics, Human Values
3.	Course relevant to Local/Regional/National/ Global needs	National and global need
4.	Course focus on Sustainable Developmental Goals	SDG 7,9,11,12,14

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	To identify various forms of renewable and non-renewable energy sources	**K1**
CO 2	Understand the principle of utilizing the oceanic energy and apply it for practical applications.	**K2**
CO 3	Discuss the working of a windmill and analyze the advantages of wind energy.	**K3**
CO 4	Distinguish aerobic digestion process from anaerobic digestion.	**K4**
CO 5	Understand the components of solar radiation, their measurement and apply them to utilize solar energy.	**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	2	2	1	2	2	3	3	2	2
CO 2	2	2	2	1	2	3	3	3	2	2
CO 3	2	2	2	1	2	3	3	3	2	2
CO 4	2	2	2	1	2	3	3	3	2	2
CO 5	2	2	2	1	2	3	3	3	2	2

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

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

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**INTRODUCTION TO ENERGY SOURCES** Conventional and non-conventional energy sources and their availability – prospects of Renewable energy sources – Energy from other sources – chemical energy–Nuclear energy– Energy storage and distribution.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**WAVE ENERGY SOURCES** Wave energy generation - Potential energy - Kinetic energy - Wave energy conversion devices - Wave energy conversion by floats - High-level reservoir wave machine – Dolphin - type wave power machine - other wave machines - Advantage and disadvantages of wave energy. Ocean thermal energy conversion.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
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.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**ENERGY FROM BIOMASS** Biomass conversion Technologies– wet and dry process– Photosynthesis -Biogas Generation: Introduction–basic process: Aerobic and anaerobic digestion – Advantages of anaerobic digestion– factors affecting bio digestion and generation of gas- bio gas from waste fuel– properties of biogas- utilization of biogas.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
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.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
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, K6

Text Books

1. Tasneem A, & Abbasi S.A. Renewable Energy Sources, PHI Learning Private Limited New Delhi(2010).
2. S. Rao and Dr. Parulekar, *Energy technology. Khanna Publishers (2009)*
3. G.D. Rai, *Non – Conventional Energy sources,* 4th edition, Khanna publishers, New Delhi (1996)

Reference Books

1. John Twidell and Tony weir, *Renewable* energy *resources*, Taylor and Francis group, London and New York (2021)
2. *Tiwari and Ghosal, Renewable* energy *resources*, Narosa Publishing House (2007)
3. Ramesh R & Kumar K.U (, Renewable Energy Technologies, Narosa Publishing (2004)

Web References

1. https://www.nationalgeographic.org/encyclopedia/tidal-energy/
2. https://www.ge.com/renewableenergy/wind-energy/what-is-wind-energy
3. https://www.acciona.com/renewable-energy/solar-energy/

Pedagogy

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

Course Designer

Dr. K. KANNAGI

SEMESTER - I	INTERNAL MARKS: 30		EXTERNAL MARKS: 70	
COUR SE CODE	COURSE TITLE	CATEGORY	HRS/WEEK	CREDITS
26PPH1DCE1C	BIOPHYSICS	DCEC-I	5	3

Course Objectives

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

Pre-requisites

- Strong foundation of biophysics
- Basic Knowledge of macromolecular mechanics

S. No.	Course Features	Relevance Status
1.	Course emphasis on Employability/Entrepreneurship/Skill Development	Employability, Entrepreneurship, Skill Development
2.	Course integrates cross cutting issues relevant to Professional Ethics/Gender sensitization/ Environment and Sustainability/ Human Values/Indian Knowledge System	Environment and Sustainability
3.	Course relevant to Local/Regional/National/ Global needs	Global need
4.	Course focus on Sustainable Developmental Goals	SDG 3,4,7,9.

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.	K6

Mapping of CO with PO and PSO

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

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

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

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**CELLULAR BIOPHYSICS** Architecture and Life Cycle of cells – Organelles of Prokaryotic and Eukaryotic cell – Cell size and shape – Fine structure of Prokaryotic and Eukaryotic cell organization – Compartment & assemblies membrane system – Extracellular matrix - Molecular mechanisms of Vesicular traffic - Electrical activities of cardiac and neuronal cells.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**MOLECULAR BIOPHYSICS** Macromolecular structure: Protein structure – amino acids, peptide bonds, primary, secondary, tertiary and quaternary structures of proteins Nucleic acid structure: nucleosides and nucleotides, RNA structure, DNA structure and conformation.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**MEMBRANE AND NEURO BIOPHYISCS** Models membranes - Biological membranes and dynamics – Membrane Capacitors – Transport across cell and organelle membranes – Ion channels. Nervous system: Organization of the nervous system –Membrane potential – Origins of membrane potential - Electrochemical potentials – Nernst equation – Goldman equation.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**RADIATION BIO PHYSICS** X-Ray: Effects on bio-macromolecules – Gamma Radiation: Molecular effects of gamma radiation, Radiation effects on nucleic acids and membranes, Effects on cell and organelles – UV radiation: Effects on biomacromolecules and proteins – Radiation hazards and protection – use of radiations in cancer.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

V	**PHYSICAL METHODS IN BIOLOGY** Spectroscopy: UV-Visible absorption spectrophotometry – Optical Rotatory Dispersion (ORD) – Structure Determination: X-ray Crystallography, Electron spin resonance (ESR) and biological applications. Chromatography: Thin layer chromatography (TLC), Gas liquid chromatography (GLC) – Centrifugation: Differential centrifugation, density gradient centrifugation.	15	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	**SELF STUDY FOR ENRICHMENT:** **(Not to be included for External Examination)** Molecular orbital theories, Hybridization of orbitals, σ and π bonds - Electron transfer phenomenon & biological energy transfer - Different types of linkages - Concept of protein evolution, Cytochrome & Hemoglobin evolutionary studies Free - radicals in biology and medicine.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books:

1. Geoffrey M. Cooper and Robert E. Hausman (2013), *The Cell: A Molecular Approach* (6th Edition), Sinauer Associates,Sunderland, Massachusetts, USA.
2. P. S. Mishra (2010), *Biophysics* (6th Edition), VK Enterprises, New Delhi, India.
3. V. Pattabhi and N. Gautham (2009), *Biophysics* (2nd Edition), Narosa Publishing, New Delhi, India.

Reference Books:

1. A. Upadhyay, K. Upadhyay, and N. Nath(2013), *Biophysical Chemistry: Principles and Techniques* (1st Edition) Himalaya Publishing House, Mumbai, India.
2. Segel F.H. (1975), *Enzyme Kinetics*,(1st Edition) John willey & sons,New York, USA.
3. Setlow R.B. and Pollard E.C. (1962), *Molecular Biophysics* (1st Edition) , Pergamon Press, Oxford, United Kingdom.

Web References

1. http://www.biology.arizona.edu/DEFAULT.html
2. http://www.cis.rit.edu/htbooks/nmr/inside.html
3. http://learn.genetics.utah.edu/content/labs/gel/
4. https://blanco.biomol.uci.edu/WWWResources.html
5. http://mw.concord.org/modeler/

Pedagogy

Lecture, Seminar, Assignments and Power Point Presentation

Course Designer

Dr.T. NOORUNNISHA

SEMESTER- III	INTERNAL MARKS : 30	EXTERNAL MARKS : 70		
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEKS**	**CREDITS**
26PPH1GE1A	**CRYSTAL GROWTH AND THIN FILM PHYSICS**	**GEC -I**	**4**	**2**

Course Objectives

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

Pre-Requisite

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

S. No.	Course Features	Relevance Status
1.	Course emphasis on Employability/Entrepreneurship/Skill Development	Employability, Entrepreneurship, Skill Development
2.	Course integrates cross cutting issues relevant to Professional Ethics/Gender sensitization/ Environment and Sustainability/ Human Values/ Indian Knowledge System	Environment and Sustainability
3.	Course relevant to Local/Regional/National/ Global needs	Global need
4.	Course focus on Sustainable Developmental Goals	SDG 3,4,7,9,12.

Course Outcome and Cognitive Level Mapping

CO Number	CO statement On the successful completion of the course, the students will be able to	Knowledge Level
CO1	Outline the basic knowledge of growth phenomena, Thin film and the theoretical aspects of nucleation , Growth, Structural and application.	K1,K2
CO2	Apply the experimental ideas of low temperature solution growth mechanism and Melt Growth.	K3,K4
CO3	Analyze the concepts on vapour growth techniques	K3,K4
CO4	Explain the process of thin films sample preparation method.	K4,K5
CO5	Formulate the latest developments in characterization techniques and analyze the usage of materials.	K5,K6

Course Outcome and Cognitive Level Mapping

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

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

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**CRYSTAL GROWTH PHENOMENA:** Nucleation - Homogeneous nucleation -Heterogeneous nucleation- Formation of nucleation - spherical nucleation - cylindrical nucleation - Growth kinetics - Singular and rough surface - Gibbs - Thomson equation - Growth from vapour – solutions - Classical theory of nucleation - Kossel, Stranski, Volmer (KSV) Theory - Burton, Cabrera and Frank (BCF) theory.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5 K6
II	**GROWTH OF SINGLE CRYSTAL:** **SOLUTION GROWTH :** Growth of crystals from solutions - solvents and solutions - solubility - preparation of a solution - saturation and supersaturation - Measurement of supersaturation - Expression for supersaturation - Low temperature solution growth - Slow cooling method - Evaporation method - Temperature gradient method - Electrocrystallization. **GEL GROWTH:** Crystal growth in gels – Experimental methods - Chemical reaction method - Reduction method - Complex decomposition method - Solubility reduction method - Growth of biologically important crystals.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5 K6
III	**VAPOUR GROWTH AND EPITAXY:** Growth of crystals from vapour phase - Physical vapour deposition - Chemical vapour transport - Thermodynamics of chemical vapour deposition process - Vapour Phase Epitaxy (VPE)- Molecular Beam Epitaxy (MBE) - Atomic Layer Epitaxy(ALE). **MELT GROWTH:** Growth of crystal from melt - Bridgman method - Kyropolous method - Czochralski method- Verneuil method – Zone melting method.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**THIN FILM STRUCTURE:** Thin film growth stage – Deposition technique – physical method – Resistive heating – Electron beam gun – Laser gun evaporation – Flash evaporation – Sputtering – Reactive sputtering – Radio frequency sputtering - chemical method – Electro deposition – Eletroless plating –deposition by chemical reaction.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

V	**STRUCTURAL ANALYSIS AND CHARACTERIZATION TECHNIQUE:** X-Ray diffraction studies (XRD) - Powder XRD equipment- Single XRD equipment -Examination of typical XRD pattern. Fourier transform infrared Analysis (FTIR) - Raman Spectroscopy - Elemental analysis – EDAX – SEM – TEM.-Micro Hardness Test - Vickers Hardness - Thermal analysis - Thermal gravimetric analysis (TGA) - Differential Thermal Analysis (DTA)	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	**SELF-STUDY FOR ENRICHMENT** (Not included for End Semester Examinations) Applications in Optoelectronics & Photonics - Wide Band-Gap Materials - Energy & Sensors - Pharmaceuticals & Bio-materials	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books:

1. Yang Leng (2013) *Materials Characterization: Introduction to Microscopic &Spectroscopic Methods* First edition Wiley & Sons.
2. Goswami A. (2008) *Thin filmfundamentals* First edition New Age, New Delhi
3. Santhanaragavan P.& P.Ramasamy (2001) *Crystal growth process &Methods* First edition KRU Publications, Kumbakonam

Reference Books

1. Sam Zhang, Lin Liand Ashok Kumar (2008) *Materials Characterization Techniques* first edition CRC Press.
2. Orhring M. (2002) *Materials Science of Thin films* second *edition* Academic Press, Boston.
3. Pamplin B.R. (1981) *Crystal Growth* First edition Pergamon Press, Oxford.

Web References

1. **https://www.worldscientific.com/worldscibooks/10.1142/10127aboutBook**
2. **https://pubs.rsc.org/en/content/articlelanding/2017/cp/c7cp01112a**
3. **https://www.alineason.com/en/knowhow/crystal-growth/**
4. **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-I	INTERNAL MARKS: 30		EXTERNAL MARKS: 70	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
26PPH1GE1B	**PHYSICS OF SENSOR AND TRANSDUCER**	**GEC-I**	**4**	**2**

Course Objectives

- To acquire the knowledge of Sensing and transducer devices.
- To understand the structural and functional principles of sensors and transducers.
- To make oneself 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 sensors and transducers.

Pre-requisites

- Fundamental knowledge of physical parameters.
- Basic idea of Sensing devices and transducers.

S. No.	Course Features	Relevance Status
1.	Course emphasis on Employability/Entrepreneurship/Skill Development	Employability, Entrepreneurship, Skill Development
2.	Course integrates cross cutting issues relevant to Professional Ethics/Gender sensitization/ Environment and Sustainability/ Human Values / Indian Knowledge System	Environment and Sustainability
3.	Course relevant to Local/Regional/National/ Global needs	Global need
4.	Course focus on Sustainable Developmental Goals	SDG 2,9,11,12.

Course Outcome and Cognitive Level Mapping

CO Number	CO statement On the successful completion of the course, students will be able to	Cognitive Level
CO 1	Remember and understand the primary idea in sensor and transducers in instrumentation.	K1, K2
CO 2	Analyze the different types of semiconductor sensors	K3
CO 3	Evaluate the working principles of sensors 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.	K6

Mapping of CO with PO and PSO

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

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

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

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**SENSOR BASICS** Introduction-Sensors, Signals, and Systems - Sensor Types - Mathematical models - Calibration - Primary measuring elements - Hysteresis - Nonlinearity - Saturation - Repeatability - Dead – Resolution.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**SEMICONDUCTOR** Introduction-Sensor Output Characteristics - Piezo resistivity in Silicon- Semiconductor Strain Gauges. Inductive Sensors: Types- Proximity Sensor- Eddy Current Sensors. Capacitive Sensors: Electrostatic Transducer - Force/Stress Sensors Using Quartz Resonators.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**SENSING TECHNOLOGIES** Capacitive Sensing- Piezoelectric Sensing- Hall Effect - Chemical Sensors- Improving Sensor Characteristics- Digital Output Sensors- Incremental Optical Encoders- Digital Techniques- Noise/Interference Aspects	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**INDUCTIVE & CAPACITIVE TRANSDUCER:** **INDUCTIVE TRANSDUCERS** Principle of operation- construction details- characteristics and Applications of LVDT **CAPACITIVE TRANSDUCERS** Principle of operation-construction details- characteristics of Capacitive transducers – different types. Applications: capacitor Microphone-capacitive pressure sensor.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

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.	12	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	**SELF STUDY FOR ENRICHMENT:** **(Not to be included for External Examination)** Characteristics – Static characteristics -Dynamic characteristics Chemical / biological characterization - Thermal Sensors Recent-Trends in Sensor Technologies.		CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

1. DVS Murthy,(2013),Transducers and Instrumentation, (2nd Edition),PHI PVT Limited, New Delhi, India.
2. D. Patranabis. D, (1997), *Sensors and Transducers*, (2nd edition), PHI PVT, Limited, New Delhi, India.
3. Randy Frank, (1995) *Understanding Smart Sensor*, (2nd edition), Artech House Boston, London.

Reference Books

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

Web References

1. https://www.geeksforgeeks.org/difference-between-sensor-and-actuator/
2. https://www.nap.edu/read/4782/chapter/4
3. https://www-physics.lbl.gov/~spieler/TSI-2007/PDF/Sensor_Physics_I.pdf
4. https://www.elprocus.com/tilt-sensor-types-working-principle-and-its-applications/
5. https://www.variohm.com/news-media/technical-blog-archive/difference-between-a-sensor

Pedagogy

Lecture, Seminar, Assignment and Power Point Presentation

Course Designer

Dr. T. NOORUNNISHA

SEMESTER - I	INTERNAL MARKS: 30		EXTERNAL MARKS: 70	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
26PPH1NME1	**TROUBLESHOOTING AND REPAIRING DOMESTIC APPLIANCES**	**NMEC – I**	**3**	**2**

Course Objectives

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

Pre-requisites

- Knowledge of the basics of electricity and Soldering.
- Fundamental ideas of physics in day-to-day life and the usage of domestic appliances.
- Primary ideas on Printed Circuit Boards.

S. No.	Course Features	Relevance Status
1.	Course emphasis on Employability/Entrepreneurship/Skill Development	Employability, Skill Development
2.	Course integrates cross cutting issues relevant to Professional Ethics/Gender sensitization/ Environment and Sustainability/ Human Values/Indian Knowledge System	Professional Ethics, Human Values
3.	Course relevant to Local/Regional/National/ Global needs	National and global need
4.	Course focus on Sustainable Developmental Goals	SDG 3,4,7,8,9,11,12

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, K6**

Mapping of CO with PO and PSO

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

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

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

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**BASICS OF ELECTRICITY** Electricity and generation - Electrical Terms - Electrical Circuits - Grounding and Polarization - Home wiring Tools - Power Station and Substation - IEE Rules - Safety and precautions.	9	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
II	**ELECTRICAL AND ELECTRONIC COMPONENTS** Active and Passive Components: Resistors - Capacitors- Fuses - Relays - Inductors - Semiconducting Devices: Diodes - Types - Transistors - Integrated Circuits - Digital ICs for logic gates - Comparison of electrical and electronic device.	9	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
III	**SOLDERING/ DE- SOLDERING TECHNIQUES** Principles of solder connections - Soldering Printed Circuit Boards (PCB) - Types of Solder - Types of PCB - Soldering flux – Soldering Irons – Flux- removal after soldering - De - Soldering – Hazards involved in soldering - Safety, health and Medical aspects in soldering.	9	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
IV	**FUNCTIONALITY OF ELECTRICAL EQUIPMENT** Main Components of a Tube Light - Solar powered street lights - Water Heater - Iron box - Purifier – Air Conditioner - Common occurring faults – Possible causes, testing and repairs.	9	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
V	**TROUBLE SHOOTING** Electrical faults - main board - distribution board - socket, plug and cord - Light fixtures (luminaires) - LED lamps - Ceiling Fans - Refrigeration System - Vacuum cleaner - Washing machine.	9	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6
VI	**SELF-STUDY FOR ENRICHMENT** (Not included for End Semester Examinations) LED Principle and working - Working of smart Gadgets - Digital display – Safety precautions for using domestic appliances.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5, K6

Text Books

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

Reference Books

1. Black Decker, The complete guide to wiring, Updated 7th Edition, Quarto Publishing Group USA (2018)
2. Ray C. Mullin, Phil Simmons, Electrical Wiring Residential, Delmar, Cengage Learning (2012)
3. Walter C Bosshart, *Printed Circuit Board,* McGraw-Hill Revised Edition (1995)

Web References

1. Soldering & Desoldering Techniques | Sciencing
2. Basic Electronics Tutorials and Revision (electronics-tutorials.ws)
3. Transformer - Definition, Types, Working Principle, Diagram (byjus.com)

Pedagogy

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

Course Designer

Dr. K. KANNAGI