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

(2024-2025 and Onwards)

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

PG &RESEARCH DEPARTMENT OF PHYSICS

VISION

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

MISSION

Our mission is two –fold.

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

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

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

PROGRAMME OUTCOMES FOR M.Sc PHYSICS PROGRAMME

PO NO.	Programme Outcome On completion of M.Sc., Physics Programme, the students will be able to
PO1	**Problem Analysis:** Provide opportunities to develop innovative design skills, including the ability to formulate problems, to think creatively, to synthesize information, and to communicate effectively.
PO2	**Scientific Skills:** Create and apply advanced techniques and tools to Solve the societal environmental issues.
PO3	**Environment and sustainability:** Ascertain eco-friendly approach for sustainable development and inculcate scientific temper in the society.
PO 4	**Ethics:** Imbibe ethical and social values aiming towards holistic Development of learners.
PO5	**Lifelong learning:** Instil critical thinking, communication, initiative which potentially leads to higher rates of employment and educational fulfillment.

PROGRAMME SPECIFIC OUTCOME FOR M.Sc., PHYSICS

PROGRAMME

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

Cauvery College for Women (Autonomous)
PG & Research Department of Physics
M.Sc., Physics
LEARNING OUTCOMES BASED CURRICULUM FRAMEWORK (CBCS – LOCF)
(For the Candidates admitted from the Academic year 2024-2025onwards)

Sem	Course	Title	Course Code	Ins. Hr Week	Credit	Exam Hrs	Marks		Total
							Int	Ext	
I	Core Course - I (CC)	Mathematical Physics	23PPH1CC1	6	5	3	25	75	100
	Core Course -II (CC)	Classical Mechanics and Relativity	23PPH1CC2	6	5	3	25	75	100
	Core Course III (CC)	Linear and Digital ICs and Applications	23PPH1CC3	6	5	3	25	75	100
	Core Practical- I (CP)	General Physics and Electronics-I(P)	23PPH1CC1P	6	5	3	40	60	100
	Discipline Specific Elective Course-I (DSE)	Physics of Nano Science and Technology	23PPH1DSE1A	6	3	3	25	75	100
		Energy Physics	23PPH1DSE1B						
		Digital Communication	23PPH1DSE1C						
	Total			**30**	**23**	**-**	**-**	**-**	**500**
	I(CCC)	Nonlinear Dynamics	22PPH2CCC1B	6	4	3	25	75	100
	TOTAL			**30**	**24**	-	-	-	**600**

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

Course Objectives

- To equip students with the mathematical techniques needed for understanding theoretical treatment in different courses taught in their program
- To extend their manipulative skills to apply mathematical techniques in their field.
- To help students apply Mathematics in solving problems of Physics
- To enhance problem solving skills and to give the ability to formulate, interpret and draw inferences from the mathematical solutions.

Pre-requisites

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

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO1	Remember and understand the various mathematical conceptsused in physics.	K1,K2
CO2	Apply mathematical tools like vector, matrix, complex integration, Fourier and Laplace series, special function will prepare the student to solve ODE; PDE's which model physical phenomena.	K3
CO3	Analyse the vector, linear, simultaneous and differential equations which will be necessary to pursue other areas in physics.	K4
CO4	Evaluate the Laplace transform and the Fourier transformations of different function, grasp how these transformations can speed up analysis and correlate their importance in technology	K5
CO5	Solve the physical problems using mathematical techniques.	K6

Mapping of CO with PO and PSO

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

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

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

Syllabus

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

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

Text Books

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

Reference Books

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

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

Web References

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

Pedagogy

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

Course Designer

Dr.R.Gayathri

Semester - I	Internal Marks: 25		External Marks: 75	
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
23PPH1CC2	**CLASSICAL MECHANICS AND RELATIVITY**	**CC-II**	**6**	**5**

Course Objective

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

Pre-requisites

- Fundamentals of mechanics,
- Foundation in mathematical methods.

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the Course, the Student will be able to	Cognitive Level
CO 1	Understand the fundamentals of classical mechanics.	K1
CO 2	Apply the principles of Lagrangian and Hamiltonian mechanics to solve the equations of motion of physical systems.	K2
CO 3	Apply the principles of Lagrangian and Hamiltonian mechanics to solve the equations of motion of physical systems.	K3 K5
CO 4	Analyze the small oscillations in systems and determine their normal modes of oscillations.	K4, K5
CO 5	Understand and apply the principles of relativistic kinematics to the mechanical systems.	K2, K3

Mapping of CO with PO and PSO

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10
CO 1	2	3	3	3	2	2	2	3	2	2
CO 2	2	3	3	3	2	2	2	3	2	2
CO 3	2	3	3	3	2	2	2	3	2	2
CO 4	2	3	3	3	2	2	2	3	2	2
CO 5	2	3	3	3	2	2	2	3	2	2

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

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

Syllabus

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

Text Books

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

Reference Books

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

Web References

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

Pedagogy

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

Course Designer

Dr. M. Kavimani

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

Course Objective

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

Pre-requisites

- Knowledge of semiconductor devices
- Basic concepts of digital and analog electronics
- Grasping Power in the concepts OP-AMP

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the course, students will be able to	Cognitive Level
CO1	Remember and understand the concepts of linear integrated circuits.	K1, K2
CO2	Analyze the linear and non-linear applications of operational amplifiers.	K3
CO3	Evaluate the basic concepts of operational amplifier, oscillator circuits and IC	K4
CO4	Apply the Principles and Concepts of waveform generation	K5
CO5	Recommend projects in electronics relevant to industrial and R &D needs	K5

Mapping of CO with PO and PSO

Cos	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5	PO1	PO2	PO 3	PO4	PO5
CO 1	3	3	3	2	1	3	3	2	2	2
CO 2	3	3	2	2	2	3	1	2	2	2
CO 3	2	3	3	2	2	3	3	1	2	2
CO 4	3	3	2	2	2	1	2	2	2	2
CO 5	3	2	2	2	1	3	3	2	3	1

“1”-Slight (Low) Correlation **“2” – Moderate (Medium) Correlation,**

“3” - Substantial(High) Correlation **“-“indicates the reisnocorrelation.**

Syllabus

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

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

Text Books

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

Reference Books

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

Web References

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

Pedagogy

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

Course Designer

Dr.K.Kannagi

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

Course Objectives

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

Pre-requisites

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

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement **On the successful completion of the Course, the Student will be able to**	Cognitive Level
CO 1	Explain the basic concepts of experimental physics.	K2
CO 2	Understand knowledge the principles of magnetism through the experiments	K2
CO 3	Explore the concepts of spectrometry involved in the optic processes.	K3
CO 4	Verify experimentally the concepts about combinational Logic circuits	K4
CO 5	Develop the skill in handling instruments in the construction of circuits	K6

Mapping of CO with PO and PSO

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

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

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

Syllabus

LIST OF EXPERIMENTS (ANY TEN)

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

Text Book

1. Ouseph C.C., Rao, U.J., & Vijayendran, V. (2009), *Practical Physics and Electronics*, S. Viswanathan, Printers & Publishers Pvt Ltd
2. Dr. Somasundaram S, (2012), *Practical Physics*, Apsara Publications
3. S. Poornachandra *Electronic Laboratory Primer a design approach*, B. Sasikala, Wheeler Publishing, New Delhi.
4. *Electronic lab manual Vol I*, K A Navas, Rajath Publishing

Reference Book

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

Web References

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

Pedagogy

Demonstration, Practical Sessions and Viva Voce

Course Designer

Dr. S. Gowri

SEMESTER- I	INTERNAL MARKS: 25			EXTERNAL MARKS: 75
COURSE CODE	**COURSE TITLE**	**CATEGORY**	**HRS/WEEK**	**CREDITS**
23PPH1DSE1A	**PHYSICS OF NANOSCIENCE AND TECHNOLOGY**	**DSE-I**	**6**	**3**

Course Objectives

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

Pre-Requisites

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

Course Outcome

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

Mapping of CO with PO and PSO

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

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

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

Syllabus

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

Text Books

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

Reference Books

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

Web References

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

Pedagogy

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

Course Designer

Dr. R. Mekala

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

Course Objectives

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

Pre-requisites

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

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the Course, the Student will be able to	Cognitive Level
CO 1	To identify various forms of renewable and non-renewable energy sources	**K1**
CO 2	Understand the principle of utilizing the oceanic energy and apply it for practical applications.	**K2**
CO 3	Discuss the working of a windmill and analyze the advantages of wind energy.	**K3**
CO 4	Distinguish aerobic digestion process from anaerobic digestion.	**K3,K4**
CO 5	Understand the components of solar radiation, their measurement and apply them to utilize solar energy.	**K2,K5**

Mapping of CO with PO and PSO

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

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

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

Syllabus

UNIT	CONTENT	HOURS	COs	COGNITIVE LEVEL
I	**INTRODUCTION TO ENERGY SOURCES** Conventional and non-conventional energy sources and their availability–prospects of Renewable energy sources– Energy from other sources– chemical energy–Nuclear energy– Energy storage and distribution.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5.
II	**ENERGY FROM THE OCEANS** Energy utilization–Energy from tides–Basic principle of tidal power–utilization of tidal energy – Principle of ocean thermal energy conversion systems.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5.
III	**WIND ENERGY SOURCES** Basic principles of wind energy conversion–power in the wind–forces in the Blades– Wind energy conversion–Advantages and disadvantages of wind energy conversion systems (WECS) - Energy storage–Applications of wind energy.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5.
IV	**ENERGY FROM BIOMASS** Biomass conversion Technologies– wet and dry process– Photosynthesis -Biogas Generation: Introduction–basic process: Aerobic and an aerobic digestion – Advantages of anaerobic digestion– factors affecting bio digestion and generation of gas- bio gas from waste fuel– properties of biogas-utilization of biogas.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5.
V	**SOLAR ENERGY SOURCES** Solar radiation and its measurements–solar cells: Solar cells for direct conversion of solar energy to electric powers–solar cell parameter–solar cell electrical characteristics– Efficiency–solar water Heater –solar distillation– solar cooking–solar greenhouse – Solar Pond and its applications.	18	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5.
VI	**SELF STUDY FOR ENRICHMENT** **(Not to be included for External Examination)** Thermo electric power – Small scale Hydro electrics – Inter connected systems-Alternative liquid fuels (Alcohol fuels)-Sun shine Recorder.	-	CO1, CO2, CO3, CO4, CO5	K1, K2, K3, K4, K5,

Text Books

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

Reference Books

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

Web References

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

Pedagogy

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

Course Designer

Dr. T.Noorunnisha

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

Course Objectives

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

Pre-requisites

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

Course Outcome and Cognitive Level Mapping

CO Number	CO Statement On the successful completion of the Course, the Student will be able to	Cognitive Level
CO 1	Apply the techniques of Fourier transform, convolution and sampling theorems in signal processing	K1, K3
CO 2	Apply different information theories in the process of study of coding of information, storage and communication	K3
CO 3	Explain and compare the various methods of pulse modulation Techniques	K4
CO 4	Apply the error control coding techniques in detecting and correcting errors- able to discuss, analyze and compare the different error control coding	K3, K4
CO 5	Apply, discuss and compare the spread spectrum techniques for secure communications	K3, k5

Mapping of CO with PO and PSO

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

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

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

Syllabus

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

Text Books

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

Reference Books

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

Web References

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

Pedagogy

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

Course Designer

Dr. T. Noorunnisha