M. Sc., PHYSICS

Syllabus

Programme Code : 2PSPHY

2022-2024

SENGAMALATHAYAAREDUCATIONALTRUST

WOMEN'S COLLEGE(AUTONOMOUS)

(Affiliated to Bharathidasan University, Tiruchirappalli)

(Accredited by NAAC) | (An ISO 9001:2015CertifiedInstitution)

PROGRAMME OUTCOMES FOR M.Sc., DEGREE

PO No.	Programme Outcomes (*Upon completion of the M.Sc. Degree Programme, the postgraduate will be able to)*
PO-1	**Disciplinary Knowledge:** demonstrate in-depth knowledge and understanding of theories, policies and practices in one or more disciplines that form a part of a Post Graduate program of study in Master of Science.
PO-2	**Critical Thinking and Problem Solving**: apply analytic thought to a body of knowledge, analyse and evaluate evidence, arguments, claims, beliefs on the basis of empirical evidence, identify relevant assumptions or implications, formulate coherent arguments, critically evaluate practices, policies and theories by following scientific approach to knowledge development: solve problems and extrapolate the same to real life situation
PO-3	**Information/digital literacy and Communication Skills**: use ICT in a variety of learning situations, demonstrate ability to access, evaluate, and use a variety of relevant information sources, and use appropriate software for analysis of data: communicate thoughts and ideas analytically and effectively in writing and orally using appropriate media, and present complex information in a clear and concise manner to different groups.
PO-4	**Research-related skills*:*** conduct independent inquiry in a chosen scientific discipline, demonstrate sense of inquiry and capability for asking relevant/appropriate questions, problematising, synthesising and articulating; recognise cause-and-effect relationships, define problems, formulate hypotheses, test hypotheses, analyse, interpret and draw conclusions from data, establish hypotheses, predict cause-and-effect relationships; plan, execute and report the results of an experiment or investigation.
PO-5	**Scientific reasoning and Reflective Thinking:** analyse, interpret and draw conclusions from quantitative/qualitative data and critically evaluate ideas, evidence and experiences from an open-minded and reasoned perspective; critically and sensibly evaluate life experiences, with self-awareness and reflexivity of both self and society.
PO-6	**Multidisciplinary Approach, Innovation and Entrepreneurship:** propose novel ideas of interdisciplinary approach in providing better solutions and new ideas for the sustainable developments; identify opportunities, entrepreneurship vision and use of innovative ideas to create value and wealth for the betterment of the individual and society.
PO-7	**Moral and ethical awareness/reasoning:** embrace moral/ethical values in conducting one's life, formulate a position/argument about an ethical issue from multiple perspectives, and use ethical practices in all work, demonstrate the ability to identify ethical issues related to one's work, avoid unethical behaviour such as fabrication, falsification or misrepresentation of data or committing plagiarism, not adhering to intellectual property rights; appreciating environmental and sustainability issues; and adopt objective, unbiased and truthful actions in all aspects of work.

PROGRAMME SPECIFIC OUTCOMES(M.Sc. PHYSICS)

PSO1: Understand and apply inter disciplinary concepts of Physics for describing the natural phenomenon.

PSO2: Demonstrate mathematical, statistical, computational and experimental techniques in problem solving.

PSO3: Implement the analytical methods required to interpret and analyze results and draw conclusions as supported by their data.

PSO4: Design the programme as a whole opens up several carrier doors for the students interested in various areas of physics in private, public and government sectors.

PSO5: Pursue research related to Physics and Materials characterization.

PSO6: Understanding the basic concepts of physics particularly concepts in classicalmechanics, quantum mechanics, electrodynamics and electronics to appreciate how diverse phenomena observed in nature follow from a small set of fundamental laws.

PSO7: Acquire scientific and problem solving skills by performing experiments in general physics and electronics

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SUNDARAKKOTTAI, MANNARGUDI - 614016.

TAMILNADU, INDIA.

M.Sc., PHYSICS CHOICE BASED CREDIT SYSTEM UNDER CBCS

(For the candidates admitted in the academic year 2022-23)

ELIGIBILITY: A pass in B.Sc. Physics/ B.Sc. Electronics/Applied Physics/ Four years Physics (Honours)

Sem.	Types of the Courses	Name of the Courses	Course Code	Ins. Hrs.	Credit	Exams Hrs.	Marks		Total
							Int.	Ext.	
I	Core Course I (CC)	Mathematical Physics	22PPH101	6	5	3	25	75	100
	Core Course II (CC)	Classical Mechanics	22PPH102	6	5	3	25	75	100
	Core Course III (CC)	Analog and Digital Electronics	22PPH103	6	5	3	25	75	100
	Core Practical I (CP)	Physics Practicals-I	22PPH104P	6	3	3	40	60	100
	Elective Course I (EC) (At least Two Choices)	Computational Physics with C++ / Physics Stimulations through Python	22PPHE1A/ 22PPHE1B	6	4	3	25	75	100
	Value Added Course I (VAC)	Energy Resources	22PPHVA11	-	2*	3	25	75	100*
		Total		**30**	**22**	**-**			**500**
II	Core Course IV (CC)	Quantum Mechanics	22PPH205	6	5	3	25	75	100
	Core Course V (CC)	Statistical Mechanics	22PPH206	5	5	3	25	75	100
	Core Course VI (CC)	Advanced Mathematics	22PPH207	5	5	3	25	75	100
	Core Practical II (CP)	Physics Practicals-II	22PPH208P	6	3	3	40	60	100
	Elective Course II (EC) (At least Two Choices)	Microprocessors and Microcontrollers / Non Linear Optics	22PPHE2A/ 22PPHE2B	5	4	3	25	75	100
	Extra Disciplinary Course I	Home Appliances / Communication Electronics	22PPHED1A / 22PPHED1B	3	2	3	25	75	100
		Total		**30**	**24**	**-**			**600**
III	Core Course VII (CC)	Advanced Quantum Mechanics	23PPH309	6	5	3	25	75	100
	Core Course VIII (CC)	Solid State Physics	23PPH310	5	5	3	25	75	100
	Core Course IX (CC)	Research Methodology	23PPH311	5	5	3	25	75	100
	Core Practical III (CP)	Physics Practicals – III	23PPH312P	6	3	3	40	60	100

	Elective Course III (EC) (At least Two Choices)	Nanotechnology / Advanced Spectroscopy	23PPHE3A / 23PPHE3B	5	4	3	25	75	100
	Extra Disciplinary Course II	Audio and Video Systems / History of Physics	23PPHED2A / 23PPHED2B	3	2	3	25	75	100
	Total			**30**	**24**	**-**	**-**	**-**	**600**
IV	Core Course X (CC)	Crystal Growth and Thin Film Physics	23PPH413	6	5	3	25	75	100
	Core Course XI (CC)	Nuclear and Particle Physics	23PPH414	6	5	3	25	75	100
	Entrepreneurship / Industry Based Course	Medical Instrumentation	23PPHI41	6	5	3	25	75	100
	Project	Project	23PPHPW	12	5	-	25	75	100
	Value Added Course II (VAC)	Solar Energy and its Utilization	23PPHVA42	-	2*	3	25	75	100*
	Total			**30**	**20**	**-**	**-**	**-**	**400**
Grand Total				**120**	**90**	**-**	**-**	**-**	**2100**

Summary of Curriculum Structure of M.Sc., Physics Programme

Sl. No.	Types of the Courses	No. of Courses	No. of Credits	Marks
1	Core Courses	11	55	1100
2	Core Practicals	3	9	300
3	Elective Courses	3	12	300
4	Entrepreneurship/ Industry Based Course	1	5	100
5	Project	1	5	100
6	Extra Disciplinary Courses	2	4	200
	Total	21	90	2100
	Value Added Courses *	2*	4*	200*

***The value added courses credit will not be included in the total CGPA.**

These courses are extra-credit courses.

Instruction hours for these courses are 30 hours.

Note:

	CIA	ESE
1. Theory	25	75
2. Practical	40	60

3. Separate passing minimum is prescribed for Internal and External marks

FOR THEORY

The passing minimum for CIA shall be 40% out of 25 marks [i.e. 10 marks]

The passing minimum for End semester Examinations shall be 40% out of 75 marks [i.e. 30 marks]

FOR PRACTICAL

The passing minimum for CIA shall be 40% out of 40 marks [i.e., 16 marks]

The passing minimum for End semester Examinations shall be 40% out of 60 marks [i.e., 24 marks]

ELECTIVE COURSES (EC) OFFERED BY THE DEPARTMENT

Semester	Course	Title of the Paper
I	Elective Course I (EC) (At least Two Choices)	Computational Physics with C++
		Physics Stimulations through Python
II	Elective Course II (EC) (At least Two Choices)	Microprocessors and Microcontrollers
		Non Linear Optics
III	Elective Course III (EC) (At least Two Choices)	Nanotechnology
		Advanced Spectroscopy

EXTRA DISCIPLINARY COURSES (EDC) OFFERED BY THE DEPARTMENT

Semester	Course	Title of the Paper
II	Extra Disciplinary Course I	Home Appliances / Communication Electronics
III	Extra Disciplinary Course II	Audio and Video Systems / History of Physics

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TAMILNADU, INDIA.

DEPARTMENTOFPHYSICS

M.Sc., PHYSICS

(For the candidates admitted in the academic year 2020 – 2021)

Question Paper Pattern – (Theory)

Max time: 3 Hours Max Marks: 75

Section – A (10 x 2 = 20)

Answer all the questions

Answer in One or Two sentences each

1.	
2.	**Unit I**
3.	
4.	**Unit II**
5.	
6.	**Unit III**
7.	
8.	**Unit IV**
9.	
10.	**Unit V**

Section – B (5 x 5 = 25)

Answer all the questions

Each answer should not exceed 500 words

11. a (or)	
b	**Unit I**
12. a (or)	
b	**Unit II**
13. a (or)	
b	**Unit III**
14. a (or)	
b	**Unit IV**
15.a (or)	
b	**Unit V**

Section – C (3 x 10 = 30)

Answer any <u>THREE questions</u> in 1200 words

16 Unit I
17 Unit II
18 Unit III
19 Unit IV
20 Unit V

SEMESTER I

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DEPARTMENT OF PHYSICS

M.Sc., PHYSICS

Semester: I- CC-I: Mathematical Physics

Ins.Hrs/Week : 5 **Course Credit: 5** **Course Code:** 22PPH101

UNIT I VECTOR ANALYSIS

Concept of vector and scalar fields – Gradient, divergence, curl and Laplacian – Vector identities – Line integral, surface integral and volume integral – Gauss theorem, Green's theorem, Stoke's theorem and their applications – Schmidt's orthogonalisation process – Schwartz inequality.

UNIT II MATRIX THEORY

Characteristic equation of a matrix – Eigen values and eigenvectors – Cayley–Hamilton theorem -Reduction of a matrix to diagonal form – Jacobi method – Sylvester's theorem.

UNIT III GROUP THEORY

Basic definitions – Multiplication table – Subgroups, cosets and classes – Point and space groups – Homomorphism and isomorphism – Reducible and irreducible representations – Schur's lemma - The great orthogonality theorem (qualitative treatment without proof) – Formation of character table of C_{2v} and C_{3v} - Elementary ideas of rotation groups.

UNIT IV DIFFERENTIAL EQUATIONS

Linear ordinary differential equations – Linear second order differential equations with variable coefficients – Frobenius method –Variation of Parameters – Sturm Liouville differential equations.

UNIT V PARTIAL DIFFERENTIAL EQUATIONS

Method of forming partial differential equations – Solution by direct integration – Method of separation of variables – Partial differential equations in physics problems – Wave equation – Equation of vibrating string – One dimensional heat flow – Two dimensional heat flow – Laplace equation.

COURSE OUTCOME:

Upon successful completion of this course the students would be able:

1. Know the basic properties of the linear vector space such as linear dependence and independence of vectors.
2. Apply matrix algebra and matrix spaces by various various mathematical methods.
3. Understand the basic of Group theory.
4. Understand the differential equations and solve the problems.
5. Solve Partial differential equations, identify complex differential functions and integral transforms.
6. Acquire knowledge of methods to solve partial differential equations with examples of important partial differential equations in Physics.

TEXT BOOKS:

1. H.K. Dass and Dr.RamaVerma, Mathematical Physics (S. Chand, New Delhi ,2016).
2. Sathyaprakash, Mathematical Physics, Sultan Chand And Sons, 6th Revised Edition ,New Delhi,2015.
3. B.D. Gupta, Mathematical Physics (Vikas Pub., Noida, 2015) 4th edition.

REFERENCE BOOKS:

1. A.W. Joshi, Matrices and Tensors in Physics (New Age, New Delhi, 2006).
2. A.B.Gupta , Fundamentals of Mathematical Physics ,4th Revised Edition , 2011.
3. L.A. Pipes and L.R. Harvill, Applied Mathematics for Engineers and Physicists (McGraw Hill, Singapore, 1967).
4. B.V. Ramana, Higher Engineering Mathematics (MaGraw Hill, New Delhi, 2013).
5. P.K .Chottapadhyay , Mathematical Physics , Wiley Eastern Ltd , New Delhi (1990).

E_RESOURCES:

1. https://bit.ly/2KMHUCC
2. https://bit.ly/3o81WWL
3. https://bit.ly/3qdWqUh

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DEPARTMENT OF PHYSICS

M.Sc., PHYSICS

Semester: I- CC-II: Classical Mechanics

Ins.Hrs/Week : 5 **Course Credit: 5** **Course Code:** 22PPH102

UNIT I FUNDAMENTAL PRINCIPLES AND LAGRANGIAN FORMULATION

Mechanics of a particle and a system of particles – Conservation laws – Constraints–Degrees of freedom– Generalized coordinates – Alembert's principle and Lagrange's equation – Hamilton's principle – Lagrange's equations of motion- Applications to linear harmonic oscillator, pendulum, compound pendulum, charged particles in an electromagnetic field and Atwood's machine.

UNIT II MOTION UNDER CENTRAL FORCE

Conservation of energy and angular momentum– Inverse square law – Kepler's problem – Virial theorem – Scattering in a central force field –Rutherford scattering cross section– Artificial satellites – Geo stationary satellites – Eccentricity of orbit of satellites – Escape velocity

UNIT III RIGID BODY DYNAMICS AND OSCILLATORY MOTION

Euler's angles– Euler's equation– Moments and products of inertia – Euler's equations - Symmetrical top – Stable and unstable Equilibrium-Theory of small oscillations – Normal modes and frequencies – Linear triatomic molecule

UNIT IV HAMILTON'S FORMULATION

Hamilton's canonical equations of motion – Hamilton's equations from variational principle – Principle of least action – Canonical transformations – Poisson bracket –phase space– Hamilton--Jacobi method – Action and angle variables – Kepler's problem in action-angle variables – Applications of Hamilton's equations of motion to linear harmonic oscillator, pendulum, compound pendulum and charged particles in an electromagnetic field.

UNIT V RELATIVISTIC MECHANICS

Reviews of basic ideas of special relativity – Energy momentum four -vector – Minkowski's four-dimensional space – Lorentz transformation as rotation in Minkowski's space – Composition of Lorentz transformation about two orthogonal directions – Thomas precession – Elements of general theory of relativity

COURSE OUTCOME:

Upon successful completion of this course the students would be able:

1. Understand the various mathematical techniques of classical mechanics
2. Have deep knowledge on Lagrange's and Hamilton formulation and their applications
3. Gain the knowledge about motion under central force
4. Study the Rigid Body Dynamics
5. Establish Hamilton formulation and their applications using differential mathematical relation.
6. Acquire the knowledge about relativistic dynamics

TEXT BOOKS:

1. S.L. Gupta, V. Kumar and H.V. Sharma, Classical Mechanics (PragatiPrakashan, Meerut,

2012).

2. H. Goldstein, C.P. Poole and J.L. Safko, Classical Mechanics (Pearson Education and Dorling Kindersley, New Delhi, 2007).

3. Dr. J.C. Upadhyaya Classical Mechanics Himalaya publishing house 2014

REFERENCE BOOKS:

1. V.B. Bhatia, Classical Mechanics (Narosa, New Delhi, 1997).

2. T.L. Chow, Classical Mechanics (John-Wiley, New York, 1995). (John-Wiley, New York, 1995).

E_RESOURCES:

1. https://bit.ly/36n6ZMM
2. https://rb.gy/6o8lzs

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DEPARTMENT OF PHYSICS

M.Sc., PHYSICS

Semester: I- CC-III: Analog and Digital Electronics

Ins.Hrs/Week : 5 **Course Credit: 5** **Course Code:** 22PPH103

UNIT I SEMICONDUCTOR DEVICES

Varactor, tunnel, Gunn, optoelectronic, LASER, LED and photo diodes –Hall effect in a semiconductor - Depletion and enhancement type MOSFFT – Characteristics of UJT-relaxation oscillator - Characteristics of SCR-90° phase control.

UNIT II OPERATIONAL AMPLIFIER

Wien bridge and phase-shift oscillators – Triangular, saw-tooth and square waves generators – Schmitt trigger – Voltage control oscillator – Phase-locked loops - Weighted resistor and binary R-2R ladder digital to analog converters -Counter type and successive approximation analog to digital converters.

UNIT III DIGITAL CIRCUITS-I

Digital comparator – Parity generator/checker – Data selector - BCD to decimal decoder – Seven segment decoder – Encoders – RS, JK, D and JK master-slaveflip-flops.

UNIT IV DIGITAL CIRCUITS-II

Serial-in serial-out, serial-in parallel-out and parallel-in serial-out shift registers – Synchronous, asynchronous, ring and up/down (using mod 10) counters --Multiplexers –Demultiplexers.

UNIT V INTEGRATED CHIPS FABRICATION AND IC TIMER APPLICATIONS

Basic monolithic ICs – Epitaxial growth – Masking – Etching, impurity diffusion – Fabricating monolithic resistors, inductors and capacitors – Circuit layout – Contacts and inter connections – Charge coupled device – Applications of CCDs -- 555 timer: Description of the functional diagram, applications of monostable and astable operations and pulse generation.

COURSE OUTCOMES

Upon successful completion of this course the students would be able:

1. Understanding the working of advanced semiconductor devices.
2. Acquiring the knowledge of the utility of OP-AMP.
3. Identifying the concept of circuital arrangements in Digital circuits.
4. Applying the knowledge of the integrated circuit fabrication.
5. Acquiring the knowledge of the Preparation of electronic gadgets.

TEXT BOOKS:

1.T.F. Schubert, E.M. Kim, *Active and Nonlinear Electronics* (John Wiley, New York,1996).

2.L. Floyd, *Electronic Devices* (Pearson Education, New York, 2013).

3.D.P. Leach andA.P.Malvino, *Digital Principals and Applications* (Tata McGraw-Hill, New Delhi,2011).

REFERENCE BOOKS:

1. R.L. Geiger, P.E. Allen and N.R Strader, *VLSI Design Techniques for Analog and Digital Circuits* (McGraw--Hill, Singapore,1990).

2. D. Roy Choudhury and S.B. Jain, *Linear Integrated Circuit* (New Age International Publications, New Delhi,2010).

3. D.Chattopadhyay and P.C. Rakshit, *Electronics Fundamentals and Applications* (New Age International Publications, New Delhi,2010).

4. .David A. Bell, Electronic Devices and Circuits, Oxford university press, New Delhi, 2008. David A. Bell, Operational Amplifiers & Linear ICs, Oxford university press, New Delhi, 2011.

5. J. Millman, C. Halkias and C.D. Parikh*, Integrated Electronics, Analog and Digital Circuits and Systems* (TMGH,2010).

E_RESOURCES:

1. https://youtu.be/1rZyGL1K5QI
2. https://youtu.be/7FYHt5XviKc

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DEPARTMENT OF PHYSICS

M.Sc., PHYSICS

Semester: I- CP-I: Physics Practical - I (General and Electronics)

Ins.Hrs/Week : 6 **Course Credit: 4** **Course Code:** 22PPH104P

Any FOURTEEN experiments.

A. General Experiments:

1. Determination of q, n, σ by elliptical fringes method.
2. Determination of Stefan's constant.
3. Determination of Rydberg's constant.
4. Study of Hall effect in a semiconductor.
5. Determination of dielectric constant at high frequency by Lecher wire.
6. Michelson interferometer -- Determination of wavelength of monochromatic source.
7. Determination of wavelength of monochromatic source using Biprism.
8. Charge of an electron by spectrometer.

B. Electronics Experiments:

1. Construction of dual regulated power supply.
2. Astable and monostablemultivibrators using IC 555.
3. Characteristics of UJT.
4. Characteristics of SCR.
5. FET amplifier.
6. Characteristics of LDR.
7. Up/down counter using mod10.
8. Operation of shift register using serial-in serial-out, serial-in parallel-out & parallel-in serial-out.
9. Digital comparator using XOR and NAND gates.
10. Study of Arithmetic Logic Unit (ALU) - IC74181

COURSE OUTCOME:

Upon successful completion of this course the students would be able:

1. Acquire the practical knowledge of certain physical constants and properties.

2. Identify the applications of electronic components & devices.

E_RESOURCE:

1. https://youtu.be/uKHuLnF9ALc

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DEPARTMENT OF PHYSICS

M.Sc., PHYSICS

Semester: I- EC-I: Computational Physics with C++

Ins. Hrs. / Week: 4 **Course Credit: 3** **Course Code:** 22PPHE1A

UNIT- I: Programming in C++ **(11 Hours)**

Constants and variables -- I/O operators and statements -- Header files -- Main function – Conditional statements -- Switch statement -- Void function -- Function program -- For, while and do-while statements--Break, continue and goto statements--Arrays.

UNIT- II: Curve Fitting and Interpolation **(14 Hours)**

Curve fitting: Method of least-squares - Straight-line fit -- Exponential and power- law fits.

Interpolation: Newton interpolation polynomial: Newton Forward and Backward interpolation formula- Linear interpolation, Higher-order polynomials and first-order divided differences–Gregory--Newton interpolation polynomials –Lagrange interpolation.

UNIT- III: Solutions of Linear and Nonlinear Equations **(13 Hours)**

Simultaneous linear equations: Upper triangular form and back substitution – Augmented matrix Solutions of linear algebraic equations-Gauss elimination method-- Jordan's modification—Inverse of a matrix by Gauss--Jordan method.

Roots of nonlinear equations: Solutions of Transcendental equations- Successive Approximation Method-Bisection Method-Newton- Raphson Method

UNIT- IV: Numerical Differentiation and Integration **(10 Hours)**

Newton's forward and backward difference formula to compute derivatives

Numerical integration: Trapezoidal and Simpson's 1/3rules-Errors in the formulae-Composite trapezoidal and Simpson's 1/3 rules-Errors in the formulae.

UNIT-V: Numerical Solution of Ordinary Differential Equations **(12 Hours)**

First-order equations: Euler and improved Euler methods–Local and global truncation errors-Second and Fourth-order Runge -Kutta method

Second-order equations: Euler methods and fourth-order Runge-Kutta method.

Total Lecture Hours- 60

COURSE OUTCOME

Upon successful completion of this course the students would be able:

1. Acquiring the knowledge of the C++ computer programming necessary for numerical simulation of physical problems.
2. Evaluation of the competence with understanding the theoretical and practical aspects of the use of numerical methods.
3. Obtaining the approximate representative numerical results of the problems
4. Applying the knowledge numerical methods of computing certain mathematical quantities, construction and evaluation of a function and solution of an ordinary differential equation.
5. Solving the problems in the field of theoretical physics and engineering which requires computing of numerical results using certain raw data.

TEXT BOOK(S)

1. J.R. Hubbard, 2006, Programming with C++, McGraw-Hill, New Delhi.
2. J.H. Mathews, 1998, Numerical Methods for Mathematics, Science and Engineering, Prentice-Hall of India, New Delhi,.
3. M.K.Venkatraman, 1999, Numerical Methods in Science and Engineering, The National Publishing Company, Madras.
4. S.S.Sastry, 2006, Introductory Numerical Methods, Prentice Hall of India, New Delhi,.
5. P.B.Patil and U.P.Verma, 2013, Numerical Computational Methods Narosa, NewDelhi.

REFERENCE BOOK(S)

1. E.Balagurusamy, 2013, Objected Oriented Programming in C++ , 6th edition ,McGrawHill, NewDelhi..
2.M.K.Jain,S.R.K.Iyengar and R.K.Jain, 1993, Numerical Methods for Scientific and Engineering Computation ,New Age International, New Delhi..

E- RESOURCES

1. MITOpenwareCoursehttps://ocw.mit.edu/courses/mathematics/18-335j-introduction-to-numerical-methods-spring-2019/
2. Courserahttps://www.coursera.org/learn/intro-to-numerical-analysis
3. Swayamhttps://swayam.gov.in/nd1_noc19_ma21/preview
4. https://drive.google.com/file/d/1ZYCtYXyk-bnS_o4T324nUbzszcC7nEb0/view
5. https://s.docworkspace.com/d/AJrQf67z-oNKgZjUoOSdFA

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DEPARTMENT OF PHYSICS

M.Sc., PHYSICS

Semester: II- EC-II: Physics Stimulations through Python

Ins.Hrs/Week : 4 **Course Credit: 4** **Course Code:** 22PPHE1B

UNIT I CURVE FITTING AND INTERPOLATION

Curve fitting: Method of least-squares - Straight-line fit -- Exponential and power- law fits.

Interpolation: Newton interpolation polynomial: Linear interpolation, Higher-order polynomials and first-order divided differences – Gregory--Newton interpolation polynomials – Lagrange interpolation.

UNIT II SOLUTIONS OF LINEAR AND NONLINEAR EQUATIONS

Simultaneous linear equations: Upper triangular form and back substitution – Augmented matrix Solutions of linear algebraic equations-Gauss elimination method -- Jordan's modification -- Inverse of a matrix by Gauss--Jordan method.

Roots of nonlinear equations: Solutions of Transcendental equations- Successive Approximation Method - Bisection Method - Newton-Raphson Method-Method of false position – Order of convergence.

UNIT III NUMERICAL INTEGRATION AND DIFFERENTIATION

Numerical integration: Trapezoidal and Simpson's 1/3 rules - Errors in the formulae - Composite trapezoidal and Simpson's 1/3 rules - Errors in the formulae.

Numerical differentiation: Two- and four-point formulae for first-order derivative - Three- and five-point formulae for second-order derivative.

UNIT IV NUMERICAL SOLUTION OF ORDINARY DIFFERENTIAL EQUATIONS

First-order equations: Euler and improved Euler methods – Local and global truncation errors-Second and Fourth-order Runge-Kutta method

Second-order equations: Euler methods and fourth-order Runge--Kutta method.

UNIT V PYTHON STRUCTUREANDCONTROL

Installing Python - Launch Python - Python modules - Python expression - objects and theirmethods-Lists -Tuples -Strings -Loops-Development Tools-SciPy and NumPy - arrays - array operations - scripts - contingent behavior - nesting - importingdata - exporting data - visualizing data - Functions - random numbers and simulation - histogramsand bar graphs -contour plots and surfaces - matrix library - Interpolation - Fourier Transform - Sparseeigen value problem

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

1. Evaluation of the competence with understanding the theoretical and practical aspects of the use of numerical methods.
2. Obtaining the approximate representative numerical results of the problems
3. Applying the knowledge numerical methods of computing certain mathematical quantities, construction and evaluation of a function and solution of an ordinary differential equation.
4. Solving the problems in the field of theoretical physics and engineering which requires computing of numerical results using certain raw data.
5. Acquiring the knowledge of the Python computer programming.

TEXT BOOKS

J. R. Hubbard, *Programming with C++* (McGraw-Hill, New Delhi,2006)
J.H. Mathews, *Numerical Methods for Mathematics, Science and Engineering*
(Prentice-Hall of India, New Delhi, 1998).

3. M.K.Venkatraman, Numerical Methods in Science and Engineering, The National Publishing Company, Madras, 1999.

REFERENCE BOOKS

1. E. Balagurusamy, *Objected Oriented Programming in C++* (McGraw Hill, New Delhi, 2013) 6thedition.
2. M.K. Jain, S.R.K. Iyengar and R.K. Jain, *Numerical Methods for Scientific and Engineering Computation* (New Age International, New Delhi,1993).
3. S.S.Sastry, Introductory Numerical Methods, Prentice Hall of India, New Delhi, 2006.
4. P.B. Patil and U.P. Verma, *Numerical Computational Methods* (Narosa, New Delhi, 2013).

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

(AUTONOMOUS)

SUNDARAKKOTTAI, MANNARGUDI- 614016

(For the Candidates admitted in the academic year 2022 – 2023)

DEPARTMENT OF PHYSICS

M.Sc., PHYSICS

Semester: I-VAC- I: Energy Resources

Ins.Hrs/Week : 4 **Course Credit: 4** **Course Code:** 22PPHVA11

OBJECTIVES

- To explain concept of various forms of Non-renewable and renewable energy
  - To outline division aspects and utilization of renewable energy sources for both domestics and industrialapplications
  - To analysis the environmental and cost economics of using renewable energy sources compared to fossilfuels.

UNIT I COMMERCIAL ENERGY (6 Hours)

Coal, Oil, Natural Gas, Nuclear power and Hydro - their utilization pattern in the past, present and future projections of consumption pattern -– environmental impact of fossil fuels

UNIT II SOLAR ENERGY (7 Hours)

Solar radiation at the earth's surface – solar radiation measurements – heating, cooling, desalination, drying, cooking, etc – solar thermal electric power plant - principle of photovoltaic conversion of solar energy

UNIT III WIND ENERGY (5 Hours)

Nature of the wind – power in the wind – factors influencing wind –wind speed monitoring - wind energy conversion devices - classification, characteristics, applications

UNIT IV BIO-ENERGY (6 Hours)

Biomass resources and their classification - direct combustion – biomass gasification - pyrolysis and liquefaction - biochemical conversion - anaerobic digestion - types of biogas

UNIT V OTHER TYPES OF ENERGY (6 Hours)

Ocean energy resources - principle of ocean thermal energy conversion (OTEC) - ocean thermal power plants - ocean wave energy conversion - tidal energy conversion

Total lecture hours: 30

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

The student will be able to do

1. Recall of commercial energy and renewable energy sources
2. Illustrate the working principle of various energy systems
3. Assemble to do basic design of renewable energy systems

BOOK FOR STUDY:

1. Sukhatme, S.P., Solar Energy, Tata McGraw Hill,1984.
2. Twidell, J.W. and Weir, A., Renewable Energy Sources, EFN Spon Ltd.,1986.
3. Kishore VVN, Renewable Energy Engineering and Technology, Teri Press, New Delhi,2012.
4. ter Gevorkian, Sustainable Energy Systems Engineering, McGraw Hill,2007.
5. Kreith, F and Kreider, J. F., Principles of Solar Engineering, McGraw-Hill,1978.

E_RESOURCES:

1. https://drive.google.com/file/d/1ZYCtYXyk-bnS_o4T324nUbzszcC7nEb0/view
2. https://s.docworkspace.com/d/AJrQf67z-oNKgZjUoOSdFA

SEMESTER II

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

(AUTONOMOUS)

SUNDARAKKOTTAI, MANNARGUDI- 614016

(For the Candidates admitted in the academic year 2022 – 2023)

DEPARTMENT OF PHYSICS

M.Sc., PHYSICS

Semester: II- CC-VII: Quantum Mechanics

Ins.Hrs/Week : 4 **Course Credit: 4** **Course Code:** 22PPH205

UNIT I SCHRÖDINGER EQUATION AND GENERAL FORMULATION

Schrödinger equation and its plane wave solution –Physical meaning and conditions on the wave function – Expectation values –Hermitian operators and their properties – Commutator relations -Uncertainty relation-- Bra and ket vectors -- Hilbert space -–Schrödinger, Heisenberg and interaction pictures.

UNIT II EXACTLY SOLVABLE SYSTEMS

Linear harmonic oscillator: Solving the one-dimensional Schrödinger equation and abstract operator method – Particle in a box --Rectangular barrier potential – Rigid rotator – Hydrogenatom.

UNIT III APPROXIMATION METHODS

Time-independent perturbation theory: Non-degenerate (first-order) and degenerate perturbation theories-Zeeman effect-Stark effect–WKB approximation and its application to tunneling problem and quantization rules**.**

Time-dependent perturbation theory: Constant and harmonic perturbations -- Transition probability – Sudden approximation.

UNIT IV SCATTERING THEORY AND ANGULAR MOMENTUM

Scattering theory: Scattering amplitude and cross-section – Green's function approach-- Born approximation and its application to square-well and screened- Coulomb potentials.

Angular momentum: Components of orbital angular momentum –Spin angularmomentum– Properties of J and J^2 – Eigenpairs of J^2 and J_z

UNIT V RELATIVISTIC QUANTUM MECHANICS

Klein--Gordon equation for a free particle and its solution –Dirac equation for a free particle and Dirac matrices -- Charge and current densities – Plane wave solution –Positive and Negative energy states – Zitterbewegung– Gamma matrices and their properties.

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

1. Study the postulates of quantum mechanics
2. Understand the concepts of one dimensional problems
3. Study the transition under constant perturbation and transition probability

4. Gain the knowledge of angular momentum , spin and their rules for quantization.
5. Understand the concepts of scattering theory
6. Acquire knowledge of quantization of fields.

TEXT BOOK(S):

1. Sathyaprakash, Quantum Mechanics, PragathiPrakashan, 2007.
2. G.Aruldhas, Quantum Mechanics PHI Learning Private Limited, Newdelhi-110001,2009
3. S. Rajasekar and R. Velusamy, Quantum Mechanics I: The Fundamentals (CRC Press, Boca Raton,2015).

REFERENCE BOOK(S):

1. R. Shankar, *Principles of Quantum Mechanics* (Springer, New Delhi,2007).
2. A.K. Ghatak and S. Lokanathan, *Quantum Mechanics:Theory&Applications* (Macmillan, Chennai, 2004) 5thedition.

3. P. M. Mathews and K. Venkatesan, *A Text Book of Quantum Mechanics* (Tata McGraw Hill, New Delhi,1987).
4. L. Schiff, *Quantum Mechanics* (Tata McGraw Hill, New Delhi, 2014) 4thedition.

E_RESOURCES:

1. https://youtu.be/IKJAJdDEqhM
2. https://youtu.be/TQKELOE9eY4

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

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SUNDARAKKOTTAI, MANNARGUDI- 614016

(For the Candidates admitted in the academic year 2022 – 2023)

DEPARTMENT OF PHYSICS

M.Sc., PHYSICS

Semester: II- CC-VII: Statistical Mechanics

Ins.Hrs/Week : 6 **Course Credit: 4** **Course Code:** 22PPH206

UNIT-I: Thermodynamics **(14 Hours)**

Thermodynamical laws and their consequences – Entropy – Changes in entropy in reversible processes – Principle of increase of entropy – Thermodynamic functions – Enthalpy, Helmholtz and Gibbs functions – Phase transitions – Clausius–Clayperon equation –VanderWall equation of state.

UNIT-II: Kinetic Theory **(11 Hours)**

Boltzmann transport equation and its validity– Boltzmann's H-theorem – Relation between H-function and entropy– Maxwell-Boltzmann distribution – Mean free path-Transport phenomena – Viscosity of gases – Thermal conductivity – Diffusion process.

UNIT-III: Classical Statistical Mechanics **(13 Hours)**

Review of probability theory – Macro and micro states – Phase space – Statistical ensembles – Density function –Liouville's theorem – Maxwell-Boltzmann distribution law – Micro canonical ensemble – Ideal gas –Entropy – Partition function – Equipartition theorem – Canonical and grand canonical ensembles.

UNIT-IV: Quantum Statistical Mechanics **(10 Hours)**

Basic concepts – Postulates– Ideal quantum gas – Bose-Einstein statistics – Photon statistics –Fermi-Dirac statistics –Sackur-Tetrode equation – Equation of state – Bose-Einstein condensation – Comparison of classical and quantum statistics.

UNIT-V: Applications of Quantum Statistical Mechanics **(12 Hours)**

Ideal Bose System: Photons – Black body and Planck radiation – Specific heat of solids – Liquid helium.

Ideal Fermi System: Properties – Degeneracy – Electron gas –Pauli paramagnetism.

Ferromagnetism: Ising and Heisenberg models.

Total Lecture Hours- 60

COURSE OUTCOMESl:

Upon successful completion of this course the students would be able:

1. Understand laws and properties of thermodynamics
2. Acquire the knowledge of kinetic theory of gases
3. Study the basics of classical statistical mechanics
4. Get the basic knowledge of quantum statistical mechanics.
5. Understand some of their applications of quantum statistics.

TEXT BOOK(S)

1. S.K. Sinha, Introduction to Statistical Mechanics (Narosa, New Delhi,2007).
2. F. Reif, Fundamentals of Statistical and Thermal Physics (McGraw Hill, Singapore, 1985).
3. K. Huang, StatisticalMechanics (Wiley Eastern Limited, New Delhi, 1963)
4. S.K.Sinha, Introduction to Statistical Mechanics, Narosa, New Delhi, 2010.
5. F.Reif, Fundamentals of Statistical and Thermal Physics,Satat Book Distributors, 2010.

REFERENCE BOOK(S)

1. Singhal, Agarwal, Prakash, *Thermodynamics and Statistical Physics* (Prakashan, Meerut,2003).
2. W. Greiner, L. Neise and H. Stocker, *Thermodynamics and StatisticalMechanics* Springer, New York, 1995).

E-RESOURCES

1. **https://cutt.ly/SvJNtyA**
2. **https://cutt.ly/rvJMVrw**

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

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SUNDARAKKOTTAI, MANNARGUDI- 614016

(For the Candidates admitted in the academic year 2022 – 2023)

DEPARTMENT OF PHYSICS

M.Sc., PHYSICS

Semester: II- CC-V: Advanced Mathematics

Ins.Hrs/Week: 5 **Course Credit: 5** **Course Code:** 22PPH207

UNIT I COMPLEX VARIABLES

Functions of complex variables- differentiability- Cauchy-Riemann conditions – Complex integration – Cauchy's integral theorem and integral formula – Taylor's and Laurent's series – Residues and singularities - Cauchy's residue theorem – Evaluation of definite integrals.

UNIT II TENSORS

Transformation of coordinates - Contravariant, covariant and mixed tensors – Rank of a tensor – Symmetric and antisymmetric tensors – Contraction of tensor- Metric tensors.

UNIT III SPECIAL FUNCTIONS

Basic properties of gamma and beta functions -- Legendre, Bessel, Laguerre: Series solution, Rodriguez formula, generating function, recurrence relations and orthogonality relations.

UNIT IV INTEGRAL TRANSFORMS

Fourier Series – Dirichlet's conditions – Determination of Fourier coefficients – Fourier integrals – Fourier transforms – Faltung theorem – Application to heat and wave equations – Laplace transform – Convolution theorem.

UNIT V GREEN'S FUNCTIONS TECHNIQUES AND INTEGRAL EQUATIONS

Green's Functions – Properties – Methods of solutions in one dimensional – Applications – Linear integral equations - Fredholm and Volterra type – Neumann series – Eigen function expansion - Applications.

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

1. Compute Cauchy's integral theorem for differential physics problems, apply method of separation variable in different coordinate systems.Understand some basic properties tensors, their symmetric and antisymmetric nature, the general tensors, contravariant , covariant and mixed tensors and their transformation properties under coordinate transformations.
2. Analyse the solutions obtained by various mathematical methods.
3. Describe the usefulness of Fourier Series in solving Problems associated with Periodicity.
5. Apply special functions to obtain the solution for complex physical problems.
6. Acquire the Knowledge about Green functions.

TEXT BOOKS:

1. H.K. Dass and Dr.RamaVerma, Mathematical Physics (S. Chand, New Delhi ,2016).
2. Sathyaprakash, Mathematical Physics, Sultan Chand And Sons, 6th Revised Edition ,New Delhi,2015.
3. B.D. Gupta, Mathematical Physics (Vikas Pub., Noida, 2015) 4th edition.
4. A.W. Joshi, Matrices and Tensors in Physics (New Age, New Delhi, 2006).

REFERENCE BOOKS:

1. L.A. Pipes and L.R. Harvill, *Applied Mathematics for Engineers and Physicists* (McGraw Hill, Singapore, 1967).

2. B.V. Ramana, Higher Engineering Mathematics (MaGraw Hill, New Delhi, 2013).

3. P.K .Chottapadhyay ,*Mathematical Physics* , Wiley Eastern Ltd , New Delhi (1990).

4.A.K. Ghatak ,I.C.Goyal and A.J .Chua , *Mathematical Physics* (McMillan , New Delhi , 1995).

5.W.W.Bell ,*Special Functions for Scientists and Engineers* (Van Nostrand , New York ,1968).

E_RESOURCES:

1. https://bit.ly/2KMHUCC
2. https://bit.ly/3o81WWL
3. https://bit.ly/3qdWqUh

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

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SUNDARAKKOTTAI, MANNARGUDI- 614016

(For the Candidates admitted in the academic year 2022 – 2023)

DEPARTMENT OF PHYSICS

M.Sc., PHYSICS

Semester: II- CP-II:PHYSICS PRACTICAL II (MICRPROCESSOR AND PROGRAMMING)

Ins.Hrs/Week : 6 **Course Credit: 5** **Course Code:** 22PPH208P

Any FOURTEEN experiments.

Microprocessor (8085):

1. Finding the largest and smallest numbers in a data array.
2. Arranging a set of numbers in ascending and descending orders.
3. Study of multibyte decimal addition and subtraction.
4. Study of seven segment display.
5. Traffic control system.
6. Generation of square and sine waves using DAC0800.
7. Control of stepper motor using microprocessor.

C++Programming:

3. Least-squares curve fitting – Straight-line fit
4. Least-squares curve fitting – Exponential fit
5. Real roots of one-dimensional nonlinear equations – Newton-Raphson method
6. Complex roots of one-dimensional non-linear equations – Newton-Raphson method.
7. Interpolation – Lagrange method.
8. Numerical integration – Composite trapezoidal rule.
9. Numerical integration – Composite Simpson's 1/3rule.
10. Solution of a second-order ODE – Euler method.
11. Solution of a first-order ODE – Fourth-order Runge-Kutta method.
12. Uniform random number generation – Park and Miller method.

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

1. Develop programming skills of microprocessor and C++ programming.

2. Solve Physics problems using qualitative and quantitative reasoning including sophisticated mathematical problems and their applications.

E_RESOURCES:

1. https://youtu.be/uvupli4nik8
2. https://youtu.be/IugJKfNhbew

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

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(For the Candidates admitted in the academic year 2022 – 2023)

DEPARTMENT OF PHYSICS

M.Sc., PHYSICS

Semester: II- EC-II: MICROPROCESSORS AND MICROCONTROLLERS

Ins.Hrs/Week : 4 **Course Credit: 4** **Course Code:** 22PPHE2A

UNIT I MICROPROCESSOR ARCHITECTURE AND INTERFACING

Intel 8085 microprocessor architecture – Pin configuration –Timing diagram – Instruction and data formats – Addressing modes – Memory mapping and I/O mapping I/O scheme -- Memory mapping I/O interfacing -Data transfer schemes -- Synchronous and asynchronous data transfer – Interrupt driven data transfer

UNIT II ASSEMBLY LANGUAGE PROGRAMS (8085 ONLY)

BCD arithmetic -- Addition and subtraction two 8-bit and 16-bit numbers --Largest and smallest numbers in a data set – Ascending order and descending order –Sum of a series of a 8-bit numbers – Sum of a series of multibyte decimal numbers – Square root of a number

UNIT III PERIPHERAL DEVICES AND MICROPROCESSOR APPLICATIONS

Programmable peripheral interface - Architecture of 8255A -Programmable DMA controller (82597)- Programmable interrupt controller (8259) -- Programmable counter-Intel 8253 --Architecture, control word and operation, Block diagram and interfacing of analog to digital converter (ADC 0800) – Digital to analog converter (DAC 0800) –7 segment LED Display –Stepper motor

UNIT-IV: MICROCONTROLLER 8051

Block diagram of Intel 8051 – Architecture –Registers– Pin configuration- Memory organization--External data and program memory -- Counters and timers – Serial data input/output – Interrupt structure–External interrupts–Addressing modes—Comparison between microprocessor and microcontroller.

UNIT-V: BASIC CONCEPTS OF ROBOTICS

Brief history-Types of Robot–Technology-Robot classifications and specifications-Design and Control issues- Various manipulators – Sensors - work cell - Mathematical representation of Robots Position and orientation – Homogeneous transformation

COURSE OUTCOME:

Upon successful completion of this course the students would be able:

1. Acquire knowledge of Intel 8085 architecture
2. Get basis knowledge of Assembly language program
3. Get the knowledge about peripheral devices and microprocessor application
4. Acquire knowledge about Intel 8051 micro controller
5. Acquire knowledge about Basic concepts of Robotics

TEXT BOOKS:

1. B. Ram, Fundamentals of Microprocessor and Microcomputers (DhanpatRaiPub.,New Delhi, 2006).

2. M.A. Mazidi, J.G. Mazidi and R.D. Mckinlay, The 8051 Microcontroller and

Embbeded Systems using Assembly and C (Dorling Kindersley, New Delhi, 2013).

3.A.P. Godse and D.A. Godse, Microprocessors and Microcontrollers (Technical Pub.,Pune, 2008).

REFERENCE BOOKS:

1. R. Gaonkar, Microprocessor Architecture, Programming and Applications with

8085 (Penram International Publishing , Mumbai, 2006) 5th edition.

2. K. Ayala, The Microcontroller (Cengage Learning India, New Delhi, 2013) 3rd edition.

E_RESOURCES:

1. https://youtu.be/XEMyFUuV31o
2. https://youtu.be/1Ei5gBBE4AA

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

(AUTONOMOUS)

SUNDARAKKOTTAI, MANNARGUDI- 614016

(For the Candidates admitted in the academic year 2022 – 2023)

DEPARTMENT OF PHYSICS

M.Sc., PHYSICS

Semester: II- EC-II: NON-LINEAR OPTICS

Ins.Hrs/Week : 4 **Course Credit: 4** **Course Code:** 22PPHE2B

UNIT I LASERS:

Gas lasers – He-Ne, Ar^+ ion lasers – Solid state lasers – Ruby – Nd:YAG,– Semiconductor lasers – Diode Laser,p-n-junction laser and GaAs laser.

UNIT II BASICS OF NON-LINEAR OPTICS:

Wave propagation in an anisotropic Crystal– Polarization response of materials to light–Harmonic generation – Second harmonic generation –Sum and difference frequency generation– Phase matching.

UNIT III MULTIPHOTON PROCESSES:

Two photon process – Theory and experiment – Three photon process – Parametric generation of light – Oscillator – Amplifier – Stimulated Raman scattering – Intensity dependent refractive index -- Optical Kerr effect– Photorefractive, electronic and optic effects.

UNIT IV NON-LINEAR OPTICALMATERIALS:

Basic requirements – Inorganics – Borates – Organics – Urea, Nitro aniline – Semiorganics – Thoreau complex – Laser induced surface damage threshold.

UNIT V FIBER OPTICS:

Step – Graded index fibers – Wave propagation – Fiber modes – Single and multimode fibers –Numerical aperture –Dispersion – Fiber bandwidth – Fiber losses-- Scattering, absorption, bending losses -- Attenuation coefficient– Material Absorption-

COURSE OUTCOMES:

Upon successful completion of this course the students would be able:

1. Understand the concept of laser action.
2. Learn the basic concept of non- linear optics.
3. Understand the principle of multiphoton processes.
4. Study the general features of non -linear optical materials.
5. Acquire the knowledge about fiber optics concept

TEXT BOOK(S):

1. W.T. Silvast, *Laser Fundamentals* (Cambridge University Press, Cambridge,2003).
2. B.B. Laud, *Lasers and Nonlinear Optics*, 3rdEdn. (New Age, New Delhi,2011).
3. R.W. Boyd, *Nonlinear Optics*, 2ndEdn. (Academic Press, New York,2003).
4. G.P.Agarwal, *Fiber-Optics Communication Systems*, 3rdEdn.(John Wiley, Singapore,2003).

REFERENCE BOOK(S):

1. K.R. Nambiar, *Lasers: Principles, Types and Applications* (New Age Inter- national Publishers Ltd, New Delhi,2014).
2. D.L. Mills, *Nonlinear Optics – Basic Concepts* (Springer, Berlin,1998).

E_RESOURCES:

1. https://bit.ly/3qomJYb
2. https://bit.ly/2JwMRix

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

(AUTONOMOUS)

SUNDARAKKOTTAI, MANNARGUDI- 614016

(For the Candidates admitted in the academic year 2022 – 2023)

DEPARTMENT OF PHYSICS

M.Sc., PHYSICS

EDC offered by the Department

Semester: II- EDC-I: Home Appliances

Ins. Hrs. /Week: 3 **Course Credit: 2** **Course Code:** 22PPHED1A

OBJECTIVES:

- To make the Students to understand the basic principles of electricity and wiring system.
- To understand the basic ideas behind electrical appliances and their applications, and electrical lamps.
- To understand the electrical measuring instruments and their uses.

UNIT- I : Caution practiced in advance **(10 Hours)**

Electricity – Basic principles - Practical unit of electricity - Electric shock– Precautions to avoid electric shock– Rescue steps in electric Shock - Electric Line Circuit Breaker (ELCB).

UNIT -II: Wiring **(9 Hours)**

Wiring system – Electric supply to house and factories – Types of wiring– Megger testing – Ear thing. Electricity in house: Design for heating element– Electric iron, Table heater, and Room heater.

UNIT -III : Electrical measuring instruments **(8 Hours)**

Moving coil instruments– Voltmeter – Ammeter – Wattmeter– Kilowatt meter– Frequency meter– Multi meter

UNIT -IV: Electrical appliances **(10 Hours)**

Electric fan– Refrigerator– Air Conditioner– Air cooler-Electric bell–Buzzer-Washing machine-Vacuum cleaner

UNIT -V: Light **(8 Hours)**

Incandescent lamp – Fluorescent lamp – LED lamp –Home light - Storage battery Solar powered street lights -.

Total Lecture Hours-45

COURSE OUTCOMES

Upon successful completion of this course the students would be able:

1. Understand the principles and working of Electricity.
2. Acquire knowledge of wiring systems.
3. Learn the electrical measuring instruments and their use and functions.
4. Understand working principles of the latest electrical appliances
5. Learn about different kinds of electrical lamps and their energy efficiency.

TEXT BOOK(S)

1. A.L.Anwaniand I.Anwani, 2003. Basic Electrical Engineering, Dhanpat Rai and Co.(P)Ltd., Delhi, (Units1to 5).
2. William D.Cooper, 1997. Electrical Instruments and Measurement Techniques, PHIPvtCo., NewDelhi, (Units2,3 &4).
3. S.P.Bali,ConsumerElectronics,2005, PearsonEducation,India
4. B.L.Theraja, 2000, Textbook of Electrical Technology ,Vol.1&2,S.Chand.
5. C.L.Wadha2011, Basic Electrical Engineering, New age International (P) Ltd, Publisher,2nd edition .
6. Sinha ShashiBhushan 2011, Hand book of Repair and Maintanance of Domestic Electronics Appliances, BPB Publication, India.

REFERENCE BOOK(S)

1. Hoerner Thomas,, 2007, Basic Electricity & Practical Wiring ,Hobar publication, Mumbai.
2. P.N.Ananthanarayanan, Basic Refrigeration and Air Conditioning 3rdedition, Tata McGraw Hill Publication Company Ltd, Newdelhi.
3. Sathish Kumar Peddapelli, Sridhar Gaddam,2020, Electrical Machines: A Practical Approach, Walter de Gruyter GmbH& Co KG.

E-RESOURCES

1. **https://youtu.be/Clvu9d73c**
2. **https://youtu.be/A5p-buWX-dA**
3. **https://youtu.be/-AY43nb_438**
4. https://youtu.be/xLjk5DrScEU
5. https://youtu.be/EZ4qUCY0Tg4

SENGAMALATHAYAAREDUCATIONALTRUSTWOMEN'SCOLLEGE

(AUTONOMOUS)

SUNDARAKKOTTAI, MANNARGUDI-614016

(For the Candidates admitted in the academic year2022–2023)

DEPARTMENTOFPHYSICS

M.Sc., PHYSICS

EDC offered by the Department

Semester: II-EDC-I: Communication Electronics

Ins. Hrs. / Week: 3 **Course Credit: 2** **Course Code: 22PPHED1B**

OBJECTIVES

- To learn about the light sources and provide Knowledge on Digital Transmission Systems
- To Gathered the basics of Modulation Techniques and study the design of Satellite Communication
- To Impart Knowledge in Fiber structure and their Properties.

UNIT-I: Fiber Structure and Properties (09 Hours)

Fiber structure – Fiber Materials – Fiber fabrication – Mechanical Properties of Fibers – Attenuation – Single distortion in Optical wave guides.

UNIT-II: Optical Sources (10 Hours)

Laser Diodes-Photo detectors-Physical Principles of Photodiodes-Photo Detector-Noise –detector response Time-Transmitter design-Optical receiver operation

UNIT-III: Digital Transmission Systems (08 Hours)

Point –to –point Links-Line Coding Coherent Optical fiber communications- Definition and Classification Coherent Systems-Semiconductor lasers.

UNIT-IV: Modulation Techniques (08 Hours)

Modulation-Demodulation-Principles of amplitude, frequency and phase Modulations-Simple circuits for amplitude, frequency and phase modulation and Demodulation.

UNIT-V: Satellite Communications (10 Hours)

Ground Station-Antenna, angle of elevation and transmission path-Various blocks of equipment abroad the satellite-Transmit and receiver contour-Block diagram of network control station (NCS) interconnecting telephone traffic between remote stations.

Total Lecture Hours-45

COURSE OUTCOMES:

1. Ability to understand and analyze the Fiber structure and Properties
2. Ability to understand and analyze Instrumentation system and their applications.
3. Understand the digital communication systems.
4. Understand the basic modulation techniques.
5. Apply the special function to solve the satellite communications

TEXTBOOK(S):

1. Metha V.K.,2013. Principles of Electronics, S. Chand & Company Ltd.,G.Keiser, Optical Fiber Communications (McGraw-Hill,NewDelhi,1991).
2. J.M Senior, 1996. Optical Fiber Communications; Principles and Practice (Prentice Hall, New Delhi).
3. G.Kennedy,1995. Electronic communication Systems (Tata Mc Graw Hill, NewDelhi.)
4. J.MillmanandL.C.Halkias,1972. Electronics Devices and circuits (Mc Graw Hill, Singapore.

REFERENCEBOOK(S):

1. Anokh Singh and Chopra A.K.,2013 Principles of communication Engineering, S. Chand & Company PVT. Ltd.,
2. Mani I. P.,2016. A text book of Engineering Physics, Dhanam Publications, Chennai.
3. Dennis Roddy and John Coolen, 1990 .Electronic Communication, PHI,
4. William C.Y. lee,1991. Cellular telecommunication (second edition), Tata Mcgraw hill.
5. PoornimaThangamI,2012..Satellitecommunication,CharulathaPublications,

E-RESOURCES

1. https://youtu.be/1rZyGL1K5QI
2. https://youtu.be/7FYHt5XviKc\
3. https://youtu.be/kiiA6WTCQn0
4. https://youtu.be/KynKHr2cXgk
5. https://youtu.be/mHvV_Tv8HDQ

SEMESTER III

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

(AUTONOMOUS)

SUNDARAKKOTTAI, MANNARGUDI- 614016

(For the Candidates admitted in the academic year 2022 – 2023)

DEPARTMENT OF PHYSICS

M.Sc., PHYSICS

Semester: III- CC-VII: ADVANCED QUANTUM MECHANICS

Ins.Hrs/Week : 6 Course Credit: 5 Course Code: 23PPH309

UNIT-I: IDENTICAL PARTICLES AND SPIN

Introduction-Physical Meaning of Identity- Symmetrical and Antisymmetrical wave functions—Exchange Degeneracy-Particle Exchange operator-The Pauli's Exclusion Principle-Spin angular momentum-Electron spin hypothesis: Stern gerlach experiment-Limitations of Stern gerlach experiment –Spin matrices for Electron

UNIT-II: APPROXIMATION METHODS FOR TIME DEPENDENT PERTURBATIONTHEORY

Time dependent Perturbation theory - first order transitions – constant perturbation- transition probability: Fermi Golden Rule –Periodic perturbation –harmonic perturbation – adiabatic and sudden approximation.

Semi-classical theory of radiation: Application of the time dependent perturbation theory to semi- classical theory of radiation – Einstein's coefficients – absorption - induced emission-spontaneous emission – Einstein's transition probabilities- dipole transition - selection rules – forbidden transitions.

UNIT-III: VARIATION METHOD

Variation method: Variation Principle – upper bound states- ground state of Helium atom – Hydrogen molecule-WKB approximation - Schrodinger equation-Asymptotic solution-validity of WKB approximation- solution near a turning point – connection formula for penetration barrier – Bohr-Summer field quantization condition- tunneling through a potential barrier.

UNIT–IV: QUANTUM THEORY OF ATOMIC AND MOLECULAR STRUCTURE

Central field approximation: Residual electrostatic interaction-spin-orbit interaction- Determination of central field: Thomas Fermi statistical method-Hartree and Hartree-Fock approximations (self consistent fields) – Atomic structure and Hund's rule.

UNIT-V: QUANTISATION OF FIELDS

The Classical Approach to Field Theory-Relativistic lagrangian and Hamiltonian of a Charged Particle in an Electromagnetic Field-The Lagrangian and Hamiltonian formulations- Quantum equation for the Field- Second Quantization Quantisation of Non relativistic Schroedinger Equation-Second quantization of Klein gorden equation

COURSE OUTCOMES:

1. Understand the identical particles and spin
2. Learn about the approximation methods for time dependentperturbation theory.
3. Understand the Variation method.
4. Study the quantum theory of atomic and molecular structures.
5. Study the theory of relativistic quantum mechanics and field quantization.

BOOKS FOR STUDY:

1. A Text book of Quantum Mechanics - P. M. Mathews and K. Venkatesan, TataMcGraw –Hill Publications, Second Edition, 2010.
2. Quantum Mechanics - Satya Prakash, Kedar Nath Ram Nath and Co. Publications,2018.
3. Claude Cohen-Tannoudji, Bernard Diu, Franck Laloë , Quantum Mechanics(Vol. II),Quantum Mechanics (Vol. II), John Wiley Publications, 2008.

BOOKS FOR REFERENCE:

1. Quantum Mechanics V. K. Thankappan, New Age International (P) Ltd.Publication,Second Edition, 2003.
2. Quantum mechanics - Franz Schwabl, Narosa Publications, Fourth Edition, 2007.
3. Molecular Quantum mechanics - P.W.Atkins and R.S. Friedman,), OxfordUniversityPress publication, Fifth Edition, 2010.
4. Quantum Mechanics – Theory and Applications, A. K. Ghatak andLokanathan,Macmillan India Ltd Publication, Fifth Edition, 2015.
5. Quantum Mechanics - Leonard I. Schiff, McGraw-Hill International Publication, ThirdEdition,1968.
6. Quantum Mechanics - E. Merzbacher, John Wiley Inter science Publications, Third Edition,2011.
7. Fundamental principles of Quantum mechanics with elementary applications - Edwin C. Kemble, Dover Publications, ReIssue Edition, 2005.
8. Principle of Quantum Mechanics - R. Shankar, Plenum US Publication, Second Edition,1994.

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

(AUTONOMOUS)

SUNDARAKKOTTAI, MANNARGUDI- 614016

(For the Candidates admitted in the academic year 2022 – 2023)

DEPARTMENT OF PHYSICS

M.Sc., PHYSICS

Semester: III- CC-VIII: SOLID STATE PHYSICS

Ins. Hrs./Week : 5 Course Credit: 5 Course Code:23PPH310

UNIT I: CRYSTAL PHYSICS (15 Hours)

Types of lattices - Miller indices – Symmetry elements and allowed rotations - Simple crystal structures – Atomic Packing Factor- Crystal diffraction - Bragg's law – Scattered Wave Amplitude - Reciprocal Lattice (sc, bcc, fcc). Structure and properties of liquid crystals. Diffraction Conditions - Laue equations - Brillouin zone - Structure factor - Atomic form factor - Inert gas crystals - Cohesive energy of ionic crystals - Madelung constant - Types of crystal binding (general ideas).

UNIT II: LATTICE DYNAMICS (13 Hours)

Lattice with two atoms per primitive cell - First Brillouin zone - Group and phase velocities - Quantization of lattice vibrations - Phonon momentum - Inelastic scattering by phonons - Debye's theory of lattice heat capacity - Thermal Conductivity - Umkalapp processes.

UNIT III: THEORY OF METALS AND SEMICONDUCTORS (16 Hours)

Free electron gas in three dimensions - Electronic heat capacity - Wiedemann-Franz law - Band theory of metals and semiconductors - Bloch theorem - Kronig-Penney model - Semiconductors - Intrinsic carrier concentration – Temperature Dependence - Mobility - Impurity conductivity – Impurity states - Hall effect - Fermi surfaces and construction - Experimental methods in Fermi surface studies - de Hass-van Alphen effect .

UNIT IV: MAGNETISM (15 Hours)

Diamagnetism - Quantum theory of paramagnetism - Rare earth ion - Hund's rule - Quenching of orbital angular momentum - Adiabatic demagnetization - Quantum theory of ferromagnetism - Curie point - Exchange integral - Heisenberg's interpretation of Weiss field - Ferromagnetic domains - Bloch wall - Spin waves - Quantization - Magnons - Thermal excitation of magnons - Curie temperature and susceptibility of ferrimagnets - Theory of antiferomagnetism - Neel temperature.

UNIT V:SUPER CONDUCTIVITY (16 Hours)

Experimental facts: Occurrence - Effect of magnetic fields - Meissner effect – Critical field – Critical current - Entropy and heat capacity - Energy gap - Microwave and infrared properties - Type I and II Superconductors.

Theoretical Explanation: Thermodynamics of super conducting transition - London equation - Coherence length – Isotope effect - Cooper pairs – Bardeen Cooper Schrieffer (BCS) Theory – BCS to Bose – Einstein Condensation (BEC) regime- Nature of paring and condensation of Fermions. Single particle tunneling - Josephson tunneling - DC and AC Josephson effects - High temperature Superconductors – SQUIDS.

Total Instruction Hours-75

COURSE OUTCOMES:

CO 1:Student will be able to list out the crystal systems, symmetries allowed in a system and also the diffraction techniques to find the crystal structure

CO 2: Students will be able to visualize the idea of reciprocal spaces, Brillouin Zone and their extension to band theory of solids.

CO 3: Student will be able to comprehend the heat conduction in solids

CO 4: Student will be able to generalize the electronic nature of solids from band theories.

CO 5: Student can compare and contrast the various types of magnetism and conceptualize the idea of superconductivity.

BOOKS FOR STUDY:

1.C. Kittel, 1996, *Introduction to Solid State Physics,* 7th Edition, Wiley, New York.
2.Rita John, Solid State Physics, Tata Mc-Graw Hill Publication.
3.A. J. Dekker, *Solid State Physics*, Macmillan India, New Delhi.
4.M. Ali Omar, 1974, *Elementary Solid State Physics – Principles and Applications,* Addison - Wesley
5.H. P. Myers, 1998, *Introductory Solid State Physics,* 2nd Edition,Viva Book, New Delhi.

BOOKS FOR REFERENCE:

1.J. S. Blakemore, 1974 , *Solid state Physics,* 2nd Edition, W.B. Saunder, Philadelphia
2. H. M. Rosenburg, 1993, *The Solid State,* 3rd Edition, Oxford University Press, Oxford.
3. J. M. Ziman, 1971, Principles *of the Theory of Solids*, Cambridge University Press, London.
4.C. Ross-Innes and E. H. Rhoderick, 1976, *Introduction to Superconductivity,* Pergamon, Oxford.
5.J. P. Srivastava, 2001, *Elements of Solid State Physics,* Prentice-Hall of India, New Delhi.

E-RESOURCES

1. http://www.physics.uiuc.edu/research/electronicstructure/389/389-cal.html
2. http://www.cmmp.ucl.ac.uk/%7Eaph/Teaching/3C25/index.html
3. https://www.britannica.com/science/crystal
4. https://www.nationalgeographic.org/encyclopedia/magnetism/

5.https://www.brainkart.com/article/Super-Conductors_6824/

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

(AUTONOMOUS)

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(For the Candidates admitted in the academic year 2022 – 2023)

DEPARTMENT OF PHYSICS

M.Sc., PHYSICS

Semester: III-CC-IX: RESEARCH METHODOLOGY

Ins. Hrs. /Week : 5 **Course Credit:5** **Course Code : 23PPH311**

OBJECTIVES

- To highlights the various postulates of research problems, research design, writing a thesis and
- To understand how to carry out research problem individually in a perfect scientific method.

Unit-I: Research Ethics **(13 Hours)**

Philosophy- definition, nature, scope and concept. Ethics-definition, moral philosophy, nature of moral judgments and reactions. Ethics with respect to science and research –Scientific misconducts- falsification, fabrication and plagiarism-Use of plagiarism software-Turnitin, Urkund and other open source software tools.

Redundant publications-duplicate and overlapping publications. Publication ethics-definition and importance. Publication misconduct- definition ,concept, problems that lead to unethical behavior, types, Violation of publication ethics, authorship and contributor ship. Software tool to identify predatory publications developed by SPPU. Subject specific ethical issues-authorship, Conflicts of interest.

Unit - II: Introduction to Research Methodology **(13 Hours)**

Meaning of Research- Objectives of Research- Types of Research- Research approaches- Significance of Research- Research methods versus Methodology- Research and Scientific method- Criteria of a good Research

Unit-III:Research Problem and Research Design **(15Hours)**

Research Problem : Selecting the Research problem – Necessity of defining the problem – Techniques involved in defining a problem- Conclusion

Research Design: Formulation of Research design – Need for Research design – Features of a good design – Basic Principle of Experimental Design.

Unit-IV: Interpretation and Report Writing (17 Hours)

Meaning and Technique of interpretation – Precautions in interpretation – Significance of report writing - Different steps in writing a report – Layout of a Research report-Types of report – Mechanics of writinga research report – Precautions for writing a research report – Evaluation - Conclusion.

Unit -V: Statistical Techniques and Computer Based Tools (17 Hours)

Statistical Techniques : Introduction of statistics – Functions – Limitations – Measures of central tendency - Arithmetic mean – Median – Mode – Standard deviation – Co-efficient of variation (Discrete serious and continuous serious) – Correlation - Regression – Multiple Regression.

Computer Based Tools: Introduction to Origin 8- Introduction to MATLAB- Introduction to Gaussian Method- Quantum analysis

Total Instruction Hours-75

COURSE OUTCOMES:

CO1. Analyze the research ethics
CO2. Show the research problems in various techniques.CO3. Explain the report writing.
CO4. Write the Formulation of Research design and Need for Research design.
CO5.List out the Statistical technique and tools.

TEXT BOOK(S):

1. A Hand Book of Methodology of Research, Rajammall, P. Devadoss and K.Kulandaivel,RMM Vidyalaya press, 1976.
2. Research Methodology Methods & Techniques, C.R. Kothari – New Age international Publishers, Reprint 2008.
3. Thesis and Assignment Writing, J. Anderson, Wiley Eastern Ltd., 1997.

REFERENCE BOOK(S)

1. Research Methodology, Mukul Gupta, Deepa Gupta – PHI Learning Private Ltd., New Delhi, 2011.
2. Fundamentals of Mathematical statistics, S.C. Gupta and V.K. Kapoor, Sultan Chand& Sons, New Delhi,1999.
3. Statistical Methods , G.W. Snedecor and W.G. Cochrans, Lowa state UniversityPress,1967.

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DEPARTMENT OF PHYSICS

M.Sc., PHYSICS

Semester: III- CP-III: PHYSICS PRACTICALS - III

Ins.Hrs/Week : 6 Course Credit: 3 Course Code: 23PPH312P

Any 12 Experiments

1. Self Inductance of a coil – Anderson Bridge.
2. Laser Source – Wavelength Measurement.
3. Thermal Conductivity – Forbe's Method.
4. Digital to Analog converter – R – 2R Ladder and Binary Weighted Method.
5. Encoder and Decoder.
6. Polarisibility of Liquid using Spectrometer.
7. Study of Flip-flops.
8. BCD to Seven Segment decoder – Seven Segment LED Display.
9. Hyperbolic Fringes – Young's Modulus and Poisson's ratio of a Glass.
10. Four Probe Method – Energy Band Gap of a Semiconductor.
11. Characteristics of a Load Cell.
12. Finding of e/m - Zeeman Effect.
13. Characteristics of Tunnel diode.
14. Design of Multiplexer and De-multiplexer.
15. Determination of Carrier Concentration and Hall Co-efficient in Semiconductors.
16. Design of Asynchronous Counter.
17. Study of Transistor Amplifiers.
18. Solar cell characteristics.
19. Michelson Interferometer – Wavelength and thickness of a film.
20. Characteristics of tri-colour LED and production of different colours.

COURSE OUTCOMES:

Having successfully completed the course, the student will be able to:

- Understand the concepts and use research equipment (microscope, oscilloscope, etc.) for materials analysis and data acquisition.
- Design and conduct experiments that probe materials properties.
- Apply math, science concepts to the analysis of experimental data.
- Work independently and function as a team.
- Develop communication skills (oral, graphic and written).
- Apply a methodology for materials selection to scientific problems.
- Locate or estimate materials data and information relevant to a successful designanalysis.

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DEPARTMENT OF PHYSICS

M.Sc., PHYSICS

Semester: III- EC-III: NANOTECHNOLOGY

Ins. Hours/Week : 5 **Course Credit: 4** **Course Code: 23PPHE3A**

OBJECTIVES

- Physics of Nanoscience and Technology is concerned with the study, creation, manipulation and applications at nanometer scale.
- 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.

UNIT I: FUNDAMENTALS OF NANOSCIENCE AND TECHNOLOGY (10 Hours)

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..

UNIT II: PROPERTIES OF NANOMATERIALS (14 Hours)

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).

UNIT III: SYNTHESIS AND FABRICATION (12 Hours)

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.

UNIT IV: CHARACTERIZATION TECHNIQUES (12 Hours)

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.

UNITVAPPLICATIONS OF NANOMATERIALS (12 Hours)

Sensors: Nanosensors 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 – super capacitors - photovoltaics.

Total Instruction Hours:60

OUTCOMES:

CO 1: Understand the basic of nanoscience and explore the different types of nanomaterials and should comprehend the surface effects of the nanomaterials.

CO 2: Explore various physical, mechanical, optical, electrical and magnetic properties nanomaterials.

CO 3: Understand the process and mechanism of synthesis and fabrication of nanomaterials.

CO 4: Analyze the various characterization of Nano-products through diffraction, spectroscopic, microscopic and other techniques.

CO 5: Apply the concepts of nanoscience and technology in the field of sensors, robotics, purification of air and water and in the energy devices.

TEXT BOOK(S)

1. A textbook of Nanoscience and Nanotechnology, Pradeep T., Tata McGraw-Hill Publishing Co. (2012).
2. Principles of Nanoscience and Nanotechnology, M.A. Shah, Tokeer Ahmad, Narosa Publishing House Pvt Ltd., (2010).
3. Introduction to Nanoscience and Nanotechnology, K. K. Chattopadhyay and A.N. Banerjee, PHI Learning Pvt. Ltd., New Delhi, (2012).
4. Nanostructured Materials and Nanotechnology, Hari Singh Nalwa, Academic Press, (2002).

5. Nanotechnology and Nanoelectronics, D.P. Kothari,
6. V. Velmurugan and Rajit Ram Singh, Narosa Publishing House Pvt. Ltd, New Delhi. (2018)

REFERENCE BOOK(S)

1. Nanostructures and Nanomaterials – Huozhong Gao – Imperial College Press (2004).
2. Richard Booker and Earl Boysen, (2005) Nanotechnology, Wiley Publishing Inc. USA
3. Nano particles and Nano structured films; Preparation, Characterization and Applications, J. H. Fendler John Wiley and Sons. (2007)
4. Textbook of Nanoscience and Nanotechnology, B. S. Murty, et al., Universities Press. (2012)

5. The Nanoscope (Encyclopedia of Nanoscience and Nanotechnology), Dr. Parag Diwan and Ashish Bharadwaj (2005) Vol. IV - Nanoelectronics Pentagon Press, New Delhi.

E-RESOURCES

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

Books for Study

1. B S Murty, P Shankar, Baldev Raj, B B Rath, James Murday, Textbook of Nanoscience and Nanotechnology, Springer-Universities Press, 2013.
2. Sulabha K. Kulkarni, Nanotechnology: Principles and Practices, Springer publications, 3rd edition, 2015.

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

(AUTONOMOUS)

SUNDARAKKOTTAI, MANNARGUDI- 614016

(For the Candidates admitted in the academic year 2022 – 2023)

DEPARTMENT OF PHYSICS

M.Sc., PHYSICS

Semester: III- EC-III: Advanced Spectroscopy

Ins. Hours/Week : 5 **Course Credit: 4** **Course Code: 23PPHE3B**

Unit - I: Microwave Spectroscopy (15 Hours)

Characterization of Electromagnetic Radiation - Regions of the Electromagnetic spectrum, Intensity of spectral lines - Rotation of Molecules, Rotational Spectra - A Diatomic Rigid Rotator - Intensity of Spectral lines - Effect of isotopic substitution, the non-rigid rotator, spectrum of a non-rigid rotator - Poly atomic molecules - Linear molecules - symmetry top molecules - asymmetry top molecules.

Unit - II: Infra-Red Spectroscopy (15 Hours)

The vibrating diatomic molecule - Simple Harmonic Oscillator - the anharmonic oscillator, the diatomic vibrating rotator, the vibrations of polyatomic molecules - fundamental vibrations and their symmetry - overtones and combination frequencies, Influence of rotation on the spectra of linear polyatomic molecules - parallel vibrations, perpendicular vibrations, influence of nuclear spin.

Unit - III: Raman Spectroscopy (15 Hours)

Introduction - Quantum theory of Raman effect - Classical theory of Raman effect - Pure rotational Raman spectra - Linear molecules, symmetry top molecules, asymmetry top molecules - vibrational Raman spectra - Raman activity of vibrations - rule of Mutual Exclusion - Rotational fine structure - Structure determination from Raman and Infra-red spectroscopy Near Infra-red FT-Raman spectroscopy.

Unit - IV: Electronic Spectroscopy of Molecules (15 Hours)

Electronic spectra of Diatomic molecules - Born Oppenheimer approximation - vibrational coarse structure, Frank-Condon Principle - Intensity of vibrational - electronic spectra - dissociation energy and dissociation products - Rotational Fine Structure of Electronic -Vibration Transitions - Molecular photo-electronspectroscopy- X-rayphotoelectronspectroscopy.

Unit - V: Spin Resonance Spectroscopy and Mossbauer Spectroscopy (15 Hours)

Spin and an applied field - nature of spinning particles - interaction between spin and a magnetic field - population of energy levels - the Larmor Precession - NMR spectroscopy for Hydrogen Nuclei - Chemical shift - the coupling constant - coupling between several nuclei.

Electron-spin Resonance Spectroscopy - g factor - hyperfine structure due to electron - nucleus coupling - double resonance - fine structure due to electron - electron coupling.

Principles of Mossbauer Spectroscopy - Applications of Mossbauer spectroscopy - chemical shift - quadrupole effect - effect of a Magnetic field.

Book for Study

1. Colin N. Banwell and Elaine M. Mccash, Fundamentals of molecular spectroscopy, 4th edition, Tata mcgraw-hill ltd, 2014.

Books for Reference

1. G. Aruldhas, Molecular Structure and Spectroscopy, (2nd Edition), PHI Learning Private Ltd. 2014.
2. Straughan and Walker, Spectroscopy Volume 1-3 Chaman & Hall Publishers, E-Book, 2nd Jan.2019.
3. Gurdeep R Chatwal and Sham K Anand, Spectroscopy, Himalaya Publishing House, 2009.

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

(AUTONOMOUS)

SUNDARAKKOTTAI, MANNARGUDI- 614016

(For the Candidates admitted in the academic year 2022 – 2023)

DEPARTMENT OF PHYSICS

M.Sc., PHYSICS

Semester: III-EDC-II: Audio and Video Systems

Ins. Hrs. /Week: 3 **Course Credit: 2** **Course Code: 23PPHED2A**

OBJECTIVES

- To know the characteristics of sound.
- To study the main features of audio and video devices.
- To understand the concept of digital television and the development in the recent technology

UNIT-I: Characteristics of Sound **(8 Hours)**

Nature of sound –Sensitivity of human ear for sound –Loudness and Phon – Frequency of sound waves – Pitch – Production of audio waveforms.

UNIT-II: Audio System **(9 Hours)**

Microphones: Characteristics of microphones –Types of Microphones – Moving coil microphone – Crystal microphone – Carbon microphone – Special microphone.
APP Applications: Zoom meeting – Whatsapp – Instagram - Video conferencing – Interactions-Googlemeet(smart classroom).

UNIT-III: Television **(10 Hours)**

Monochrome Television: Introduction to television – Basic monochrome television system – Transmitter – Receiver – Television camera tubes – Videocon camera tube.
Colour Television: Colour Transmission and Reception – Colour combination – Three colour theory – Colour TV transmitter and receiver – Colour picture tube – CCTV.

UNIT-IV: Digital Television **(9 Hours)**

Digital Television-Transmission and Reception: Digital system hardware, digital satellite television, Direct –To – Home (DTH) satellite television, Digital TV receiver.

UNIT-V: Liquid Crystal Screen Television **(9 Hours)**

LCD technology - LCD matrix types and operation - LCD screens for television - LED TV.

Total Lecture Hours-45

COURSE OUTCOME

The student will be able to,

1. Understand the theory and model in image and video processing.
2. Know the characteristics of sound.
3. Understand the working principles and main features of audio and video devices.
4. Understand the concept of digital television
5. Improve the advanced technology

TEXT BOOK(S)

1. N.Subramanyam Briji Lal, Sound, Vikas Publication House PVT LTD,Second Edition Jan 2018
2.R G Gupta, Audio and Video Systems (Principles, maintenance and trouble shooting), TataMcGraw – Hill Publishing Company Limited, New Delhi, 2002. (Unit I, II)
3. George Kennedy, Bernard Davis, S R M Prasanna, Electronic Communication Systems, Tata McGraw – Hill Publishing Company Limited, New Delhi, 2012, (Unit III).
4. R.R.Gulati, Modern Television Practice (Fourth revised edition), New Age International Publishers2007.(Unit IV & V).
5. Benjamin Gross, The Tvs of Tomorrow ,University of Chicago press,First Edition 2018.

REFERENCE BOOK(S)

1. A.M.Dhake, Television & Video Engineering (Second edition) , McGraw Hill education Limited,May1999.
2. Bali & Bali, Audio Video Systems Principles, Practices and Troubleshooting, Khanna PublishingCompany,2010.
3.S.P.Bali, Consumer Electronics, Pearson Education,India,2005
4. D.S.Bormane, P.B.Mane, R.R.Itkarkar, Television Engineering Wiley,Jan 2015

E_RESOURCES

1. **https://youtu.be/PE6On4ZiEyo**
2. **https://youtu.be/Dns-TSudyh4**

SENGAMALATHAYAAREDUCATIONALTRUSTWOMEN'SCOLLEGE

(AUTONOMOUS)

SUNDARAKKOTTAI, MANNARGUDI-614016

(Forthe Candidatesadmittedintheacademic year2022–2023)

DEPARTMENTOFPHYSICS

M.Sc.,PHYSICS

Semester: III EDC-II: History of Physics

Ins. Hrs./Week:3 CourseCredit:2 Course Code: 23PPHED2B

OBJECTIVES

- To learn about the light sources and provide Knowledge on Digital Transmission Systems
- To Gathered the basics of Modulation Techniques and study the design of Satellite Communication
- To Impart Knowledge in Fiber structure and their Properties.

OBJECTIVES

- To understand the historical development of basic concepts in physics.
- To evaluate contribution of well-known scientists
- To understand the basic concept of electric charges and recent advanced technology

UNIT-I: Ancient Greeks to Newton (08 Hours)

Pythagoras – Democritus's theory – Copernicus – Aryabhata – Kepler and the elliptical orbit – Laws of motion and telescope – Newton and his three laws of motion and gravity

UNIT-II: Light, Gases, Atomic structure and Thermodynamics (10 Hours)

Light – Newton's corpuscular theory-Young and double slit experiment – Fresnel and light waves – Development of science of gases – Pascal and Boyle – Atomic theories of Dalton and Bohr – The birth of thermodynamics – Joule's measurement – The first and second Laws..

UNIT-III: Electricity and Magnetism (09 Hours)

Experiments of Galvani, Oersted, Ampere, Faraday, Coulomb, Rutherford and Benjamin Franklin – Volta and the birth of battery – Thomas Alva Edison – Maxwell and his field – Hysteresis loop – Superconductors.

UNIT-IV:Quantum Mechanics and Relativity (09 Hours)

Planck's idea – Einstein's Photoelectric effect – Schrodinger and his wave equation – Heisenberg's uncertainty principle – Stern-Gerlach experiment – Einstein's special theory of relativity – Twin paradox – General theory of relativity.

UNIT-V: Physics in India (09 Hours)

Why is the sea blue?- Raman effect- Bose and his statistics – Bosons and Bose condensation - Whited wafts Sakha and his ionization formula – Homi Baba: Research findings- The Institution builder

Total Lecture Hours-45

COURSE OUTCOME

The students will be able to,

1. Acquire the knowledge about basic theory of physics
2. Understand the historic development of ideas on light ,gas and atomic structure
3. Study the ideas of Electricity magnetism
4. Acquire the knowledge of quantum theory and relativity
5. Evaluate the contribution of most prominent scientists to the development of physics.

TEXT BOOK(S)

1. G.Venkataraman , Raman and His effect (University press, Hyderabad, 1995)
2. F. Reif, *Fundamentals of Statistical and Thermal Physics* (McGraw Hill, Singapore, 1985).
3. K.K.ChopraandG.C.Agarwal, *Electromagnetic Theory*(K.Nath &Co., Meerut).
4. S.L.Gupta,V.KumarandH.V.Sharma,ClassicalMechanics (Pragati Prakashan,Meerut,2012).
5. G.Venkataraman ,Bhabha and His Magnificient Obsessions (University press, Hyderabad, 1994)

REFERENCE BOOK(S)

1. R.Spangerrburg and DK.Moser "The History of Science from the ancient Greeks to the scientific revolution (University press, Hyderabad, 1999)
2. Singhal, Agarwal, Prakash, Thermodynamics and Statistical Physics (Prakashan, Meerut,2003).
3. D.J.Griffiths,Introduction toElectrodynamics(Pearson, Essex,2014)4thedition
4. T.L.Chow,ClassicalMechanics(John-Wiley,NewYork,1995).(John-Wiley,NewYork,1995).
5. R.Spangerrburg and DK.Moser "The History of Science from 1900-1945 (University press, Hyderabad, 1999)

E_RESOURCES:

1. **https://youtu.be/IKJAJdDEqhM**
2. **https://youtu.be/TQKELOE9eY4**
3. **https://youtu.be/IKJAJdDEqhM**
4. **https://bit.ly/3qomJYb**
5. **https://youtu.be/r-shNhpBkhs**

SEMESTER IV

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

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(For the Candidates admitted in the academic year 2022 – 2023)

DEPARTMENT OF PHYSICS

M.Sc., PHYSICS

Semester: IV- CC-X: CRYSTAL GROWTH AND THIN FILM PHYSICS

Ins. Hours/Week : 6 **Course Credit: 5** **Course Code: 23PPH413**

Unit-I: Nucleation

Primary nucleation - Secondary nucleation - Solubility, super solubility and metastable zone - Crystal growth theories: surface energy theories, adsorption layer theories, kinematic theories,and diffusion reaction theories

Unit–II: Crystal Growth from Melt and Vapour

Czochralski method - Bridgmann - Stockbarger method - Zone Melting Method -Vapour growth: direct vapour transport method, Chemical transport method

Unit - III: Crystal Growth from Solution

Solution and Solubility - Choice of Solvent - Additives - Nucleation - Achievement of Supersaturation - Mason-Jar Method - Holden's Rotary Crystallizer - Temperature Differential Method - growth from silica gel - High temperature solution growth - Flux growth - Top seeded solution growth -Hydrothermal growth

Unit - IV: Thin Film Deposition: Physical Vapour Deposition

Evaporation method: Vacuum evaporation, Electron beam evaporation - DC diode sputtering, Magnetron sputtering, Reactive ion sputtering, RF sputtering - Pulsed Laser Deposition - Molecular Beam Epitaxy

Unit - V: Thin Film: Deposition Chemical Vapour Deposition and Liquid Phase Deposition

Chemical vapour deposition **-** typical chemical reactions - reaction kinetics - transport phenomena - CVD methods – Metal Organic Chemical Vapour Deposition - Plasma enhanced chemical vapour deposition - Langmuir-Blodgett films - Electrochemicaldeposition - Sol-gel films.

Books for Study

1. W Mullin, Butterworth-Heinemann, Crystallization, 4th edition, Oxford, 2001.
2. H. L. Bhat, Introduction to crystal growth principles and practice, CRCPress Taylor &Francis Group, New York, 2015.
3. Hartmut Frey, Hamid R. Khan,Handbookof Thin-FilmTechnology,Springer-Verlag BerlinHeidelberg, 2015.
4. Guozhong Cao, Nanostructures and nanomaterials: synthesis, propertiesand applications,Imperial college press, London, Reprinted 2006

Books for Reference

1. Crystal growth processes and methods, P. Santhana Raghavan, P.Ramasamy, KruPublications, Kumbakonam, India, 2000.
2. Handbook of thin film deposition, processes and techniques,Krishna Seshan, NoyesPublication, USA, 2nd edition 2002.
3. Handbook of Thin Film Technology, Leon I. Maissel, Reinhard Glang,McGraw Hill HigherEducation, New York, 1970.

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(For the Candidates admitted in the academic year 2022 – 2023)

DEPARTMENT OF PHYSICS

M.Sc., PHYSICS

Semester: IV- CC-XI: NUCLEAR AND PARTICLE PHYSICS

Ins. Hours/Week : 6 **Course Credit: 5** **Course Code: 23PPH414**

Unit-I: Basic Properties of Nucleus (18 Hours)

Nuclear mass and binding energy - atomic masses - systematics of nuclear binding energy - nuclear size - charge radius - potential radius - spin and parity - statistics of nucleus - magnetic dipole moment – electric moments - electric quadrupole moments - isospin - nuclear forces-ground state of the deuteron - wave equation for the deuteron and solution - excited state of deuteron - low energy proton neutron scattering - spin dependence of n-p interaction. Liquid Drop Model - Evidence of Shell Structure - Single Particle Shell Model

Unit-II: Nuclear Decay and Radio Activity (18 Hours)

Theory of alpha disintegration - hindrance and formation factors - fine structure of alpha decay - energetics of beta decay - neutrino hypothesis - Fermi theory of beta decay - selection rules - Sargent diagram - orbital electron capture - parity non conservation - double beta decay - gamma ray spectra and nuclear energy level - radioactive transition in nuclei-nuclear isomerism - internal conversion - resonance fluorescence - angular correlation.

Unit-III: Nuclear Reactions (18 Hours)

Types of nuclear reactions - conservation laws - reaction energetics - Q value - threshold energy - nuclear reaction cross section - level width - compound nuclear theory - Breit Wigner dispersion formula and interpretation - direct reaction - striping and pickup reactions - nuclear fission - energy released in fission - nuclear chain reaction - four factor formula - nuclear reactor - nuclear fusion - Stellar energy.

Unit-IV: Particle Physics (18 Hours)

Production of new particles in high energy reaction - classification of elementary particle - fundamental interaction - quantum numbers - antiparticles - resonances - law in production and

decay process - symmetry and conservation laws - special symmetric groups - Gelman -Neumann theory - Quark model - SU(3) symmetry - unification of fundamental interactions - CPT in variance and applications of symmetry arguments to particle reaction, parity non conservation in week interaction.

Unit-V: Cosmic Rays and Applications of Nuclear Physics (18Hours)

Nature of Cosmic rays - soft and hard components - Instruments and apparatus used in research of cosmic rays - absorption of cosmic ray - discovery of positron - cosmic ray shower discovery of muons - properties of ì - meson - discovery of Pi meson - Trace Element Analysis - Diagnostic Nuclear Medicine - Therapeutic Nuclear Medicine.

Books for Study

1. S.N. Ghoshal, Nuclear Physics, S. Chand and company Ltd., 2003.
2. Satya Prakash, Nuclear Physics and Particle Physics, First edition, Sultan Chand and sons,2014.
3. S.L. Kakani, Shubhrakakani, Nuclear Particle and Physics, Second edition, Vivo books(private) Ltd, 2013.
4. Kenneth S. Krane-Introductory Nuclear Physics, 3rd edition, John Wiley and Sons, New York,1988.

Books for Reference

1. Pandya and Yadav-Nuclear and Particle Physics world, Cambridge University Press, Reprint2004.
2. Bernard L. Cohen -Concepts of Nuclear Physics, Tata McGraw Hill Publishing Co., NewDelhi. Reprint 2002.
3. Irwing Kaplan, Nuclear Physics, 2nd edition, Addison-Wesley Pub. Co., Reprint 2001.

SENGAMALA THAYAAR EDUCATIONAL TRUST WOMEN'S COLLEGE

(AUTONOMOUS)

SUNDARAKKOTTAI, MANNARGUDI- 614016

(For the Candidates admitted in the academic year 2022 – 2023)

DEPARTMENT OF PHYSICS

M.Sc., PHYSICS

Semester: IV- Entrepreneurship/Industry Based Course: Medical Instrumentation

Ins. Hrs. /Week: 6 **Course Credit: 5** **Course Code: 23PPHI41**

OBJECTIVES

- To gain the knowledge about medical terms and Radiology techniques
- To understand the uses of light in medicine and Ultrasonic in medicine
- Acquire the knowledge about computer uses in medicine

UNIT -I: Medical Terminology and Measurement (13 Hours)

Terminology and measurement –Applications of electricity and magnetism in medicine-Electrical shock, High frequency Electricity in medicine- Low frequency electricity and magnetism in medicine.

UNIT- II: Radiology (12 Hours)

MRI- Computed tomography - Positron emission tomography - X – RAY- Radiation Protection in Diagnostic Radiology-Radiation protection in Radiation therapy-- Radio frequency, Infrared and Ultraviolet radiation production.

UNIT -III: Light In Medicine (11 Hours)

Measurement of light and its units, Application of ultraviolet and infrared light medicine, Lasers in medicine-Physics of diagnostic X rays-Producing live X-ray images-Fluoroscopy.

UNIT- IV: Ultrasonic's in Medicine (11 Hours)

Propagation of ultrasound in biological materials- Principles of Echo ranging – A Scan-– Identification of early pregnancy-fetal growth - Safety of diagnostic ultrasound- Ultrasonic holography.

UNIT- V: Computers in Medicine (13 Hours)

History taking-Laboratory Automation-Electrocardiogram interpretation-Patient monitoring-Drug – test interactions-Prescribing drug dosage-Medial record systems-Hospitals book keeping- Other uses of computers in medicine.

Total Lecture Hours- 60

COURSE OUTCOME

The students will able to

1. Understand the concept of medical terms and measurements.
2. Gain the knowledge about Radiology concepts.
3. Understand the uses of light in medicine.
4. Acquire the knowledge about ultrasonic's in medicine.
5. Understand the computer applications used in medical physics

TEXT BOOK(S)

1. John R.Cameron &James G.Skofronick, Medical Physics, A Willey-Inter science Publication, John Willey & Sons.
2. M.Arumugam, 2004, Bio Medical instrumentation, Anuradha Publishing Co, Kumbakonam, Tamilnadu,
3. Paras N.Prasad, 2003, Introduction to Biophotonics, John Wiley and Sons lnc
4. W.R.Handee, 2003, Medical Radiation Physics, Year book Medical Publishers lnc., London.
5. J.P.Woodcock, 2002, Ultrasonic Medical Physics Hand book series1, Adam Hilger Bristol

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REFERENCE BOOK(S)

1. B.H.Brown, R.H.Smallwood, D.C.Barber, P.V.Lawford and D.R.Hose, 1998, Medical Physics and Biomedical Engineering, CRC Press.
2. K.Thayalan, 2014, The Physics Of Radiology And Imaging, Jaypee Brothers Medical Publishers.
3. T.Rajalakshmi, 2008, Bio Medical Instrumentation, First Edition, Sams Publishers.
4. R.S.Khandpur, 2007, Hand Book of Bio Medical Instrumentation, Tata McGraw Hill.
5. G.K.Knoff,A.S.Bassi, 2007, Smart Biosensor Technology, CRC Press,2006.

E_RESOURCES:

1. https://nptel.ac.in/courses/115/102/115102017/
2. https://nptel.ac.in/courses/115/106/115106087/
3. https://radiologykey.com/clinical-radiation-generators/
4. https://spie.org/news/spie-professional-magazine-archive/2011-january/lasers-inmedicine?SSO=1
5. https://nptel.ac.in/noc/courses/noc19/SEM1/noc19-cy13/

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(For the Candidates admitted in the academic year 2022 – 2023)

DEPARTMENT OF PHYSICS

M.Sc., PHYSICS

Semester: IV- VAC-II: SOLAR ENERGY AND ITS UTILIZATION

Ins. Hours/Week : NIL Course Credit: 2* Course Code: 23PPHVA42

Unit - I: Energy Scenario & Solar Energy Option

Introduction - Survey of production and Reserves of Commercial Energy sources - World - India - Alternate Solar option. Thermal Collection and Storage - Thermal Application - some observation.

Unit - II: Solar Installation

Solar Spectrum - Effects of Earth's Atmosphere - Measurement of Irradiance - Solar Simulation - Solar Cell Testing Methods - The effect of temperature and illumination on cell efficiency - Loss Analysis.

Unit - III: Solar Thermal Collectors

Characteristics of the materials - Flat Plate Collectors - Tubular Solar Energy Collectors - Fresnel Reflector and Lenses (parabolic).

Unit - IV: Solar Energy Storage

Sensible heat Storage - Phase Transition Chemical Storage - Rechargeable Batteries - Solar Pond.

Unit - V: Other Methods of Solar Energy Utilization and Analysis

Photovoltaic Conversion - Wave Energy - Ocean Thermal Energy conversion - Annular Solar Savings - Concluding remarks.

Books for Study

1. Sukhatme, Nayak, "Solar Energy Principles of Thermal Collection and Storage", Tata McGraw-Hill Publishing Company, 2008.
2. D Yogi Goswami, "Principles of Solar Engineering", CRC press, 2015.
3. Alan L. Fahrenbruch, Richard H. Bube, "Fundamentals of Solar Cells - Photovoltaic Solar Energy Conversion", Academic Press, 1983.
4. lian Chen, "Physics of Solar energy", Wiley; 1st edition, 2011.