Punyashlok Ahilyadevi Holkar Solapur University, Solapur

NAAC Accredited-2015
'B' Grade (CGPA 2.62)

Name of the Faculty: Science & Technology

Choice Based Credit System (CBCS)

Syllabus: Physics (Solid State)

Name of the Course: M. Sc. I (Sem.– I & II)

(Syllabus to be implemented with effect from June 2021)

Punyashlok Ahilyadevi Holkar Solapur University, Solapur

M. Sc. I – Physics (Solid State)
Choice Based Credit System
w.e.f June 2020-21

Semester	Code	Title of the Paper	Semester exam			L	T	P	Credits
First		**Hard core**	**Theory**	**IA**	**Total**				
SS	**HCT1.1**	Mathematical Physics	80	20	100	4		-	4
	HCT1.2	Solid State Physics	80	20	100	4		-	4
	HCT1.3	Analog & Digital Electronics	80	20	100	4		-	4
		Soft Core (Any one)							
	SCT1.1	Classical Mechanics	80	20	100	4		-	4
	SCT1.2	Elements of Material Science	80	20	100	4		-	
		Tutorial		25	25		1	-	1
		Practical							
	HCP 1.1	Practical HCP 1.1	40	10	50	-	-	2	6
	HCP1.2	Practical HCP 1.2	40	10	50	-	-	2	
	HCP1.3	Practical HCP 1.3	40	10	50	-	-	2	
		Soft core (Any one)							
	SCP1.1	Practical SCP1.1	40	10	50	-	-	2	2
	SCP1.2	Practical SCP1.2	40	10	50	-	-	2	
		Total for first semester	**480**	**145**	**625**				**25**
Second		**Hard core**							
SS	**HCT2.1**	Quantum Mechanics	80	20	100	4		-	4
	HCT2.2	Electrodynamics	80	20	100	4		-	4
		Soft core (Any one)							
	SCT2.1	Statistical Physics	80	20	100	4		-	4
	SCT2.2	Analytical Techniques	80	20	100	4		-	
		Open elective (Any one)							
	OET2.1	Fundamentals of Electronics	80	20	100	4		-	4
	OET2.2	Conventional & Non-conventional Energy	80	20	100	4		-	
		Tutorial		25	25		1	-	1
		Practical							
	HCP 2.1	Practical HCP 2.1	40	10	50	-	-	2	4
	HCP2.2	Practical HCP 2.2	40	10	50	-	-	2	
		Soft core (Any one)							
	SCP1.1	Practical SCP2.1	40	10	50	-	-	2	2
	SCP1.2	Practical SCP2.2	40	10	50	-	-	2	
		Open elective (Any one)							
	OEP2.1	Practical OEP2.1	40	10	50	-	-	2	2
	OEP2.2	Practical OEP2.2	40	10	50	-	-	2	
		Total for second semester	**480**	**145**	**625**				**25**

M.SC-I, SEME. I, PHYSICS (MATERIALS SCIENCE)
HCT - 1.1: MATHEMATICAL PHYSICS
Choice Based Credit System (CBCS)
(w. e. f. June 2020-2021)

Unit I: Calculus of Residues (15)

COMPLEX VARIABLE AND REPRESENTATIONS: Algebraic Operations, Argand Diagram: Vector Representation, Complex Conjugate, Euler's Formula, De Moiver's Theorem, The n^{th} Root or Power of a complex number.

ANALYTICAL FUNCTIONS OF A COMPLEX VARIABLE : The Derivative of f(Z) and Analyticity, Harmonic Functions, Contour Integrals, Cauchy's Integral Theorem, Cauchy's Integral Formula,

Zeros, Isolated Singular points, Evaluation of Residues, Cauchy's Residue theorem.

Unit II : Operator and Matrix Analysis (15)

Vector Space and its dimensionality, Vector Spaces and Matrices, Linear independence; Bases; Dimensionality, linear dependence, Inner product Hilbert space, linear operators.

Matrix operations, properties of matrices, Inverse, Orthogonal and unitary matrices; Independent elements of a matrix Diaglonization; Complete orthogonal sets of functions, special square matrices, Eigen values and eigenvectors; Eigen value problem.

Unit III: Ordinary Differential Equations (14)

First-Order homogeneous and non homogeneous equations with variable coefficients. The superposition principle, Second-order homogeneous equations with constant coefficient. Second-order non homogeneous equations with constant coefficients.

Unit IV: Fourier Series, Integral Transforms and Laplace transform (16)

Fourier Series: Fourier's theorem; Cosine, Sine and complex Fourier series, Applications to saw tooth and square waves and full wave rectifier. FS of arbitrary period; Half wave expansions; Partial sums Fourier integral and transforms; cosine since complex forms, Parsevals relation, Application to Gaussian distribution, box and exponential functions; FT of delta function.

Laplace transforms: Laplace transforms of common functions, First and second shifting theorems; inverse LT by partial fractions; LT of derivative and integral of a function.

Reference Books:

1. Introduction to Mathematical Physics by C. Harpcr, Prcnticc - Hall of India Ltd. N.Delhi 1993,(Chapters 2,4,6,9)
2. Mathematical Physics by A.G. Ghatak, I.C.Goyal and S.J.Chua, McMillan India Ltd. New Delhi 1995 (Chapters 4,7,9,10)
3. Matrices and Tensors for Physicists,by A W Joshi
4. Advanced Engineering Mathematics, by E Keryszig
5. Mathematical Method for Physicits and Engineers, by K F Reily, M P Hobson and S J Bence
6. Mathematics for Physicists by Mary L B
7. Mathematical Methods for Physics, by G Arfken

M.SC-I, SEME. I, PHYSICS (MATERIALS SCIENCE)
HCT - 1.2: SOLID STATE PHYSICS
Choice Based Credit System (CBCS)
(w. e. f. June 2020-2021)

Unit I: Crystal Structure (15)

Basic Structures, Bravais systems in 2D and 3D, Bonding in solids, Reciprocal Lattice, Diffraction by X-ray and structure factor, Point defects and dislocations,
Specific Heat: Lattice vibration, Phonons, Einstein and Debye's theories.

Unit II: Energy bands and Semiconductors (20)

Energy bands:
Metal, Insulator and Semiconductor, Bloch theorem, Electron in periodic potential -1D, Tight and loose band approach, Brillion's Zones, Fermi surfaces.

Semiconductors:
Direct and indirect band gap semiconductors, Effective mass, Hall effects and thermoelectric power, Intrinsic and Extrinsic carrier concentration.

Unit III: Dielectrics (10)

Electronic, Ionic, Orientational polarizations, Clausius-Mossotti equation, Dipole theory of ferroelectricity, Internal field in solids, Classification of magnetic materials,

Unit IV: Superconductors (15)

Basic concept, Meissner effect, Types I and II, Thermal properties of superconductor,
Thermodynamics of superconductors, London equation, Josephson tunneling and its theory, BCS theory.

Reference Books:

1) Introduction to Solid State Physics 4 th Ed. C.Kittel,

2) Solid State Physics by N.W.Ashoroff &N.D.Mermin

3) Solid State Physics S.O.Pillai (New age international limited Publications)

4) Solid State Physics by Saxena and Gupta(Pragati Editions)

5) Solid State Physics by Rita John (Mc Graw Hill)

M.SC-I, SEME. I, PHYSICS (MATERIALS SCIENCE)
HCT - 1.3: ANALOG & DIGITAL ELECTRONICS
Choice Based Credit System (CBCS)
(w. e. f. June 2020-21)

Unit I: Operational Amplifiers (15)

Differential amplifier Circuit Configurations, Dual Input Balanced Output Differential amplifier, DC analysis, AC analysis, Inverting and Non Inverting Inputs, Constant Current Bias Circuit.

Block diagram of a typical Op-Amp, Open loop configuration, Inverting and Non-inverting amplifiers, Op-amp with negative feedback, Voltage Series Feedback, Effect of feedback on closed loop gain, Input resistance, Output resistance, Bandwidth and Output offset voltage, Voltage follower.

Practical Op-amp, Input Offset Voltage, Input bias current- input offset current, total output offset voltage, CMRR frequency response.

Unit II: Applications of Op amps (15)

DC and AC amplifier, Summing, Scaling and Averaging Amplifiers, Instrumentation amplifier, Integrator and Differentiator.

Oscillator: Principles, Oscillator types, Frequency stability, Response, Phase Shift oscillator, Wein Bridge Oscillator, LC Tunable Oscillator, Multivibrators, Monostable and Astable, Comparators,

Unit III: Combinational & Sequential Logic Circuits (15)

Combinational logic:

The transistor as a switch, OR AND NOT gates- NOR And NAND gates Boolean algebra- Demorgans theorems, Multiplexers and Demultiplexers

Sequential Logic:

Flip- Flops: RS Flip- Flop, JK Flip- Flop, JK master slave Flip-Flops Flip-Flop, D Flip- Flop, Shift registers Synchronous and Asynchronous counters.

Unit IV: Microprocessors (15)

Architecture of 8085, Signals and timing diagram of 8085, Demultiplexing Address and Data bus, Instruction Set, Addressing modes, Assembly Language Programming of 8085 (Sum /Subtraction, Multiplication & Division of 4 & 8 bit numbers) .

Reference Books:

1) OP Amp amplifiers by RamakantGaikwad
2) Integrated Circuits by K.R.Botkar
3) Modern Digital Electronics by R.P.Jain
4) Digital Principle and Application by Malvino&Leeach
5) Digital Fundamentals by Floyd
6)8085 Microprocessor by Ramesh Gaonkar

M.SC-I, SEME. I, PHYSICS (MATERIALS SCIENCE)
SCT - 1.1: CLASSICAL MECHANICS
Choice Based Credit System (CBCS)
(w. e. f. June 2020-2021)

Unit I : Mechanics of Particles and Rigid Bodies (15)

Mechanics of Particle and system of Particles using vector algebra and vector calculus, Conversion laws, work-energy theorem, open systems (with variable mass), Gyroscopic forces; dissipative systems, Jacobi integral, gauge invariance, integrals of motion; symmetries of space and time with conservation laws; invariance under Galilean transformations.

Unit II: Lagrangian Formulation and Motion Under Central Force (15)

Constrainsts, Generalised co-ordinates, D Alemaberts Principle, Lagranges equations of motion, Central Force, definition and characteristics, Reduction of Two-bod problem into equivalent One-body problem, General analysis of orbits, Keplers laws and equations, Artificial satellites, Rutherford Scattering.

Unit III: Variational Principle (15)

Introduction to Calculus of variation, Variational technique for many independent variables, Eulers Lagrange differential equation, Hamilton's principle, Deduction f Lagrange's equation of motion from Hamilton's principle.
Hamilton, Generalized momentum, Constant of motion, Hamilton's canonicl equations of motion, Deduction of canonical equations from Variations principle.
Applications of Hamilton's equations of motion, Principle of least action, Proof of principles of least action, Problems.

Unit IV: Canonical Transformations and Hamilton's - Jacobi Theory (15)

Canonical Transformations, Condition for Transformation to be Canonical, Illustration of Canonical Transformation, Poisson's Brackets, Properties of Poisson's Brackets, Hamilton's Canonical equations in terms of Poisson's Brackets. Hamilton's - Jacobi Theory, Solution of harmonic oscillator problems by HJ Method, Problems.

Texts and Reference Books:

1. Classical Mechanics, By Gupta, Kumar and Sharma (Pragati Prakashan2000).
2. Introduction to Classical Mechanics, by R.G. Takwale and P S Puranik(Tata McGraw Hill 1999).
3. Classical Mechanics, by H Goldstein (Addison Wesley 1980).
4. Classical Mechanics, by N C Rana and P S Joag(Tata McGraw Hill 1991).
5. Mechanics, by A Sommerfeld (Academic Press 1952)

M.Sc-I, SEME. I, PHYSICS (MATERIALS SCIENCE)
SCT– 1.2 (MS): ELEMENTS OF MATERIALS SCIENCE
Choice Based Credit System (CBCS)
(w. e. f. June 2020-2021)

Unit I: Introduction to materials: Classification, Properties and Requirements (15)
Introduction, Classification of Engineering Materials, Metals, Alloys, ceramics, Polymers and Semiconducting materials, Application of Engineering Materials.
Chemical Bonding: Introduction, Crystalline and Non-crystalline Solids, Classification of Bonds, Ionic Bond or Electrovalent Bond, Covalent Homopolar Bonds, Metallic Bonds, Molecular Bonds, Hydrogen Bond, van der Walls bond (Inter-molecular and Intra-molecular bonds).

Unit II: Optical Properties of Materials (15)
Introduction, Classification of Optical Materials, Interaction of light with matter, Absorption in Metals, Insulators and Semiconductors, Reflection, Refraction, Transmission and Scattering, Traps, Excitons, Colour Centers, Tauc and Lambert-Beer laws, Optical properties of Photonic material.
Luminescence and Photoconductivity Luminescence: Introduction, Principle, Classification of Luminescence, Photoluminescence, Cathodoluminescence, Electroluminescence, Thermoluminescence, Phosphorescence, Chemiluminescense, Applications.
Photoconductivity: Introduction, Photoconductivity, Characteristics of Photoconductivity Materials, Photodiodes, Photoresistor, Photodetectors, Photodetector Bias Circuit, Performance of Photodetector, Applications, Light emitting diodes (LED) and LASER's.

Unit III : Functional Materials (15)
Nanophase Materials: Introduction, Synthesis and techniques, Nucleation and growth mechanism, Characterization of Nanostructured Materials, Properties of Nanophase Materials, Applications.
Advanced Ceramics: Introduction, Classification of Ceramics, Structure of the Ceramics, Ceramic Processing, Properties of Ceramics, Applications.
Polymer Materials: Introduction, Polymerization Mechanism, Degree of Polymerization, Classification of Polymers, Structures of polymer and preparation methods, important properties and applications of commercial polymers-viz-polyethylene. Polyvinylchloride, Polystyrene, Nylon, Polyesters, Silicones, Composites, Composite material including nano-materials.

Unit IV: Phase diagrams & Diffusion in Solids (15)
Phase diagrams
Phase rule, Single component system, Binary phase diagram, Microstructure changes during cooling, Lever rule, Phase diagram rules, Applications of phase diagram.

Diffusion in solids

Ficks law of diffusion (1 st& 2 nd), Applications of second law of diffusion, Kirkendall effect, Atomic model of diffusion.

Reference Books:

1. Materials Science : V. Rajendran, A. Marikani, Tata MC Graw Hill
2. Materials Science & Engineering: Raghavan, Tata MC Graw Hill
3. Materials Science: Arumugam
4. Materials Science & Metallurgy : O. P. Khanna
5. Materials Science and Engineering: Callister S.

M.SC-I, SEME. II, PHYSICS ((MATERIALS SCIENCE)
HCT - 2.1: QUANTUM MECHANICS
Choice Based Credit System (CBCS)
(w. e. f. June 2020-2021)

Unit I: Operator Formalism:
(15)

Linear Vector Spaces, Scalar Product, Schwartz Inequality, State Vector, difference between span and basis, orthogonal and orthonormal, General formalism of operator mechanics, operator algebra, commutation relations, Hermitian operator definition and properties, Relation between non commutativity of two operators and uncertainty relation, Dirac's bra-ket notations, Matrix representation of operators, state vector and scalar product. Effect of change of basis on the matrix representation, Unitary transformation.

Unit II : Introductory Quantum Mechanics:
(15)

Time dependent and time-independent Schrodinger equation, Interpretation of wave function,admissible wave functions, continuity equation, Operators, Expectation Value,Ehrenfest's theorem, Uncertainty Principle, wave packet, admissible wave functions, stationary states, postulates of quantummechanics, Eigen Values and Eigen Vectors. Momentum Eigenfunction in the coordinate representation, box normalization and Dirac Delta function. Coordinate and Momentum representations, Schrodinger equation in momentum representation. . Quantum Dynamics: Schrödinger, Heisenberg and Interaction picture.

Unit III: Solution of Schrodinger equation for some solvable systems and Angular Momentum Algebra :
(15)

Infinite and finite potential wells, Square Well potential and Nanoscience, Harmonic Oscillator by operator method, Schrodinger in spherical polar coordinate and its solution for hydrogen atom, Angular momentum algebra: Definition, Commutation relations, Simultaneous eigenfunction of $L^2$and L_z operator.

Unit IV: Addition of Angular Momenta and approximation methods: (15)

Algebra of Spin angular momenta, Pauli Spin matrices, generalized angular momentum, matrices for J^2, J_x, J_y and J_z operators, Clebich Gordon Coefficient: Construction Procedure and simple examples.

Introduction to approximation methods like Variational and WKB methods with simple examples.

Text Books:

1. Introductory Quantum Mechanics (3^{rd} Edition), D. J. Griffiths and D F Schroeter (Cambridge Univ. Press).
2. Quantum Mechanics-Theory and Applications by Ajoy Ghatak ,S. Loknathan (Sixth Edition) Publisher TRINITY
3. Introductory Quantum Mechanics by Liboff (4^{th} Edition), Publisher Pearson
4. Quantum Mechanics Concepts and Applications by Nouredine Zettili, John Wiley and Sons (second Edition)
5. Quantum Mechanics - LI. Schiff (McGraw-Hill).
6. A textbook of Quantum Mechanics - P M Mathews, K Venkatesan. (Tata McGraw Hill).
7. Concept of Modern Physics (6^{th} Edi.) A Beiser, S Mahajan and S R Choudhury. (McGraw-Hill).

M. Sc.-I, SEME. II, PHYSICS (MATERIALS SCIENCE)
HCT - 2.2: ELECTRODYNAMICS
Choice Based Credit System (CBCS)
(w. e. f. June 2020-2021)

Unit-I: Electrostatics and Magnetostatics:
(15)
Dirac delta function, Gauss's law and applications, Differential form of Gauss's law, Poisson and Laplace's equations, Electrostatic potential energy, Boundary conditions, Uniqueness theorems, Method of images, Multipole expansion.
Biot-Savart law, Ampere's law, Differential form of Ampere's law, Vector potential, Magnetic field of a localized current distribution, Boundary conditions.

Unit-II: Time varying fields and Energy, force, momentum relations:
(15)
Faraday's law, Maxwell's displacement current, Maxwell's equations, Maxwell's equations in matter, Scalar and vector potentials,
Energy relations in quasi-stationary current systems, Magnetic interaction between two current loops, Energy stored in electric and magnetic fields, Poynting's theorem, General expression for electromagnetic energy.

Unit-III: Electromagnetic wave equations:
(15)
Electromagnetic wave equations, Electromagnetic plane waves in stationary medium, Reflection and refraction of electromagnetic waves at plane boundaries (Normal and Oblique incidence), Electromagnetic waves in conducting medium, Skin effect and skin depth.
Lorentz's and Coulomb's gauges, Gauge transformations, Wave equations in terms of electromagnetic potentials, D'Alembertian operator,

Unit IV: Radiation emission:
(15)
Electric dipole, electric quadrupole and magnetic dipole radiation, Radiation by a moving charge: Lienard-Wiechert potentials of a point charge, Larmor's formula, Angular distribution of radiation. Fields and radiation of a localized oscillating source, radiation from a half wave antenna, radiation damping.

Reference Books
1.Introduction to Electrodynamics: David Griffiths (PHI)
2. Electrodyanamics J. D. Jackson
3. Introduction to Electrodynamics, A. Z. Capri and P. V. Panat (Narosa)
4. Classical theory of fields, Landau &Lifshitz
5. Electrodynamics, W. Panofsky and M. Phillips
6. Electromagnetism and Classified Theory, A. D. Barut, Dover
7. Electromagnetic theory and Electrodynamics, by Satya Prakash, KedarNath and Co.Meerut.
8. Electromagnetics by B.B.Laud, Willey Eastern.
9. Electrodynamics by Kumar Gupta and Singh.

M.SC-I, SEME. II, PHYSICS (MATERIALS SCIENCE)
SCT - 2.1: STATISTICAL PHYSICS
Choice Based Credit System (CBCS)
(w. e. f. June 2020-2021)

Unit I: Statistical Thermodynamics: (20)
Thermodynamic systems and equilibria, Laws of thermodynamics and their consequences, Nernst heat theorem, Microstates and microstates, Postulate of equal priori probability, Probability calculations, Thermodynamic potentials and Maxwell's relations, Chemical potential, phase equilibria, Black Body radiation and planks distribution, Phase equilibria, Free energy and its connection with thermodynamic quantities, entropy of mixing and Gibbs and paradox.

Unit II: Classical statistical mechanics: (15)
Statistical ensembles, Microcanonical ensemble- system in contact with heat revisor, Condition for thermal equilibrium, canonical ensemble – molecular ideal gas and grand canonical ensemble, Liouville's theorem, Ensembles, Maxwell Boltzmann distribution, classical ideal gas,

Unit III: Quantum Statistical Mechanics (15)
Phase space (Diagram of an oscillator), Maxwell- Boltzmann statistics, Fermi-Dirac statistics and Bose- Einstein statistics, Liouville's theorem, Ideal Bose gas, Ideal Fermi gas- weekly and strongly degerate , Bose- Einstein condensation.

Unit IV: Phase transitions and critical phenomena (10) Phase transition, Triple Point, Condition for phase equilibrium, First order phase transition, Ehrenfests equations, Clausius- Clayperon equation, Second latent heat equation, Examples, Second order phase transition, Critical indices, The law of corresponding states.

Reference Books:

1) Introduction to Statistical Mechanics by B.B.Laud
2) Statistical Mechanics by S.K.Sinha
3) Statistical Mechanics by I.D. Landau &F.M.Lifshitz
4) Text Book of statistical mechanics. Suresh Chandra, CBS Publications
5) Elementary Statistical Mechanics Gupta, Kumar, Pragati Prakashan.

M.SC-I, SEME. II, PHYSICS (MATERIALS SCIENCE)
SCT - 2.2: ANALYTICAL TECHNIQUES
Choice Based Credit System (CBCS)
(w. e. f. June 2020-2021)

Unit I: X-ray Diffraction techniques (18)

Review of basic crystal systems, powder diffraction method, instrumentation of X-ray diffractometer, sources of X-rays, detectors of X-rays, acquisition of raw data, data processing and refinement.

Determination of lattice parameters and crystal structure of cubic systems, structure factors, systematic absence of reflections, intensity calculations for cubic system, determination of particle size using X-ray diffractograms, basic concept for determination of lattice parameters for other crystal systems, use of soft-ware packages**.**

Unit II: Infra-red spectroscopy & Ultraviolet and visible spectrophotometry (18)

Infra-red spectroscopy (IR):

Introduction, Beer Lamberts law, Instrumentation, calculation of absorption maximum of dienes, dienons and polyenes, Qualitative and Quantitative applications.

Ultraviolet and visible Spectrophotometry (UV/Vis.):

Introduction, instrumentation, sampling technique, selection rule, types of bonds, absorption of common functional groups, Factors frequencies, applications.

Unit III: Fourier - Transform Infra Red Spectroscopy (FTIR)

Basic principle, instrumentation configuration date interpretation and analysis, and special techniques such as Attenuated Total Reflection (ATR).

Unit IV: X-ray photoelectron spectroscopy (XPS) (10)

Basic principle, instrumentation configuration, data interpretation and analysis, chemical shift, quantification, and depth-profiling.

Reference Books:

1) Elements of X –ray diffraction: B.D. Cullity, Addison-Wiely Publisher
2) Encyclopedia of materials characterization: Surfaces, Interfaces, Thin Films C. Richard Brundle, Charles A. Evans, Jr. Shaun Wilson, BUTTERWORTH-HEINEMANN
3) Nanotechnology: Principles and Practices: S.B.Kulkarni, Capital Publishing Company

M.SC-I, SEME. II, PHYSICS (MATERIALS SCIENCE)
OET - 2.1 : FUNDAMENTALS OF ELECTRONICS
Choice Based Credit System (CBCS)
(w. e. f. June 2020-2021)

UNIT 1 : Electronic Components (15)

Circuit concept Units, Standards and Dimensions. Electric current, Electric charge, potential difference, Electric power and Energy. Circuit elements : Passive elements and active elements. Network Law's, Junction Law's (KCL), Mesh Law's (KVL) Application of Network Law's to simple dc networks theorems – Thevenin's theorem, Norton's theorem Max power transfer theorem.

UNIT 2 : Semiconductor Devices (15)

Junction Diodes, p-n junction, an unbiased p-n junction, a biased p-n junction and V-I characteristics of p-n junction. Some special P-N junction: - Photodiodes, LED and Solar Cell. Junction transistor, Transistor static characteristic Self-bias or emitter bias, Two-port representation of Transistor (hybrid parameter) JFET: Static Characteristic of FET comparison of FET with Bipolar transistor.

UNIT 3: Applications of Active & Passive (15)
Operational Amplifier Characteristics and Applications

Introduction, Ideal Op-Amp, DC and AC Characteristics: Instrumentation Amplifier, V to I and I-V converter Precision rectifier, Differentiator and Integrator. Comparator Schmitt trigger wave generators (Square wave and Triangular wave) and first order Low pass and High pass filters.

UNIT 4: Special IC series (15)

Op-Amp regulator, Design of power supplies using voltage regulator ICs, 555 Timer as Monostable and Astable operation.

Reference books:

1. D Chattopadhyaya, P.C. Rakshit, B Saha and N NPurkait: Foundations of Electronics, New Age International Edition.
2. D. Roy Choudhary and ShailJain : Linear Integrated Circuit, New Age International (P) Ltd.
3. P-Amp and Linear Integrated Circuits : R. A. Gaikwad, PHI of India Ltd.
4. A Texbook of Electronics (Second Edition) : S. L. Kakani and K. C. Bhandari
5. Electronic Principles : A. P. Malvino, TMH Edition.

M.SC-I, SEME. II, PHYSICS (MATERIALS SCIENCE)
OET - 2.2: Conventional & Nonconventional Energy
Choice Based Credit System (CBCS)
(w. e. f. June 2020-2021)

Unit I: Energy Science and Energy Technology

A brief history of energy technology, Various sciences and energy science, Energy, man and environment, Thermodynamics and energy analysis, Classification of conventional and non conventional energy sources, Global energy trends,

Hydro energy-merits and demerits, Primary hydro energy resources, Types of hydroelectric plants, Energy and power equations, Hydraulic turbines,

Fossil Fuels, Conversion and applications, Types of coal, properties of coal, Coal production and processing.

Unit II: Solar Energy

The solar spectrum, Semiconductors, p-n junction, Solar photocells, Efficiency of solar cells, Commercial solar cells, Developing technologies, Solar panels, Economics of photovoltaics (PV), Environmental impact of photovoltaics, Outlook for photovoltaics,

Solar thermal power plants, Solar thermal collectors, Flat plate collectors, Parabolic collectors, paraboloidal dish collector.

Unit III: Wind and Biomass Energy

Source of wind energy, Global wind patterns, Modern wind turbines, Kinetic energy of wind, Principles of a horizontal-axis wind turbine, Wind turbine blade design, Dependence of the power coefficient C_p on the tip-speed ratioλ, Design of a modern horizontal-axis wind turbine, Turbine control and operation, Wind characteristics, Power output of a wind turbine, Wind farms, Environmental impact and public acceptance, Economics of wind power, Outlook, Conclusion,

Photosynthesis and crop yields, Biomass potential and use, Biomass energy production, Environmental impact of biomass, Economics and potential of biomass, Outlook, Biogas plants, Types of Biogas plants

Unit IV: Nuclear Energy

Binding energy and stability of nuclei, Fission, Thermal reactors, Thermal reactor designs, Fast reactors, Present-day nuclear reactors, Safety of nuclear power, Economics of nuclear power, Environmental impact of nuclear power, Public opinion on nuclear power, Outlook for nuclear power, Magnetic confinement, D-T fusion

reactor, Performance of tokamaks, Plasmas, Charged particle motion in E and B fields, Tokamaks, Plasma confinement, Divertor tokamaks, Outlook for controlled fusion.

Reference Books:

1. Energy Technology: Nonconventional, Renewable & Conventional by S. Rao and B.B. Parulekar (3rd Edition, Khanna Publishers).
2. ENERGY SCIENCE: principles, technologies, and impacts, John Andrews and Nick Jelley, Oxford University Press.