[2020-21 Batch onwards]

I Year B.Sc.-Physics:I Semester

UNIT-I:

1. Mechanics of Particles (5 hrs)

Review of Newton's Laws of Motion, Motion of variable mass system, Motion of a rocket, Multistage rocket, Concept of impact parameter, scattering cross-section, Rutherford scattering-Derivation.

2. Mechanics of Rigid bodies (7 hrs)

Rigid body, rotational kinematic relations, Equation of motion for a rotating body, Angular momentumand Moment of inertia tensor, Euler equations, Precession of a spinning top, Gyroscope, Precession of atom and nucleus in magnetic field

UNIT-II:

1. Motion in a Central Force Field (12hrs)

Central forces, definition and examples, characteristics of central forces, conservative nature of central forces, Equation of motion under a central force, Kepler's laws of planetary motion-Proofs, Motion of satellites, Basic idea of Global Positioning System (GPS), weightlessness, Physiological effects of astronauts

UNIT-III:

1. Relativistic Mechanics (12hrs)

Introduction to relativity, Frames of reference, Galilean transformations, absolute frames, Michelson-Morley experiment, negative result, Postulates of Special theory of relativity, Lorentz transformation, time dilation, length contraction, variation of mass with velocity, Einstein's mass-energy relation

UNIT-IV:

1. Undamped, Damped and Forced oscillations: (07 hrs)

Simple harmonic oscillator and solution of the differential equation, Damped harmonic oscillator, Forced harmonic oscillator – Their differential equations and solutions, Resonance,Logarithmic decrement, Relaxation time and Quality factor.

2. Coupled oscillations: (05 hrs)

Coupled oscillators-Introduction, Two coupled oscillators, Normal coordinates and Normal modesand wave equation Ncoupled oscillator

Unit-V:

1. Vibrating Strings: (07 hrs)

Transverse wave propagation along a stretched string, General solution of wave equation and its significance, Modes of vibration of stretched string clamped at ends, Overtones and Harmonics,Melde's strings.

2. Ultrasonics: (05 hrs)

Ultrasonics, General Properties of ultrasonic waves, Production of ultrasonics by piezoelectric and magnetostriction methods, Detection of ultrasonics, Applications of ultrasonic waves, SONAR

REFERENCE BOOKS:

- Fundamentals of Physics Vol. I - Resnick, Halliday, Krane ,Wiley India 2007
- College Physics-I. T. Bhimasankaram and G. Prasad. Himalaya Publishing House.

experiments to be done and recorded:

1. Young's modulus of the material of a bar (scale) by uniform bending
2. Young's modulus of the material a bar (scale) by non- uniform bending
3. Surface tension of a liquid by capillary rise method
   rectangular Bifilar suspension –Moment of inertia body.
4. Rigidity modulus of material of a wire-Dynamic
5. Volume resonator experiment Determination of 'g' by compound/bar
6. Simple pendulum- normal distribution of errors-estimation of time period

and the errorof the mean by statistical analysis

I Year B.Sc.-Physics II Semester

Course-II: WAVEOPTICS

UNIT-I Interference of light: (12hrs) Introduction, Conditions for interference of light, Interference of light by division of wave front and amplitude,Phase change on reflection-Stokes' treatment, Lloyd's single mirror,Interference in thin films: Plane parallel and wedge-shaped films, colours, Newton's rings in reflected light- in thin films Theory and experiment, Determination of wavelength of monochromatic light, Michelson interferometer and determination of wavelength.

UNIT-II Diffraction of light:(12hrs)

Introduction, Types of diffraction: Fresnel and Fraunhoffer diffractions, Distinction between Fresnel and Fraunhoffer diffraction,Fraunhoffer diffraction at a single slit, Plane diffraction grating,Determination of wavelength of light using diffraction grating, Resolving power of grating, Fresnel's half period zones, Explanation of rectilinear propagation of light, Zone plate, comparison of zone plate with convex lens

UNIT-III Polarisation of light:(12hrs)

Polarized light: Methods of production of plane polarized light, Double refraction, Brewster's law, Malus law, Nicol prism, Nicol prism as polarizer and analyzer, Quarter wave plate, Half wave plate, Plane, Circularly and Elliptically polarized light-Production and detection, Optical activity, Laurent's half shade polarimeter: determination of specific rotation, Basic principle of LCDs

UNIT-IV Aberrations and Fibre Optics: (12hrs)

Monochromatic aberrations, Spherical aberration, Methods of minimizing spherical aberration, Coma, Astigmatism and Curvature of field, Distortion; Chromatic aberration-the achromatic doublet; Achromatism for two lenses (i) in contact and (ii) separated by a distance.

Fibre optics: Introduction to Fibers, different types of fibers, rays and modes in an optical fiber, Principles of fiber communication (qualitative treatment only), Advantages of fiber optic communication.

UNIT-V Lasersand Holography:(12hrs)

Lasers: Introduction, Spontaneous emission, stimulated emission, Population Inversion, Laser principle, Einstein coefficients, Types of lasers-He-Ne laser, Ruby laser, Applications of lasers; Holography: Basic principle of holography

REFERENCE BOOKS:

- Unified Physics Vol.IIOptics, Jai PrakashNath&Co.Ltd., Meerut
- Optics,F.A. Jenkins and H.G.White, McGraw-Hill

Practical Course II: Wave Optics

1. Resolving power of grating.
2. Study of optical rotation –polarimeter.
3. Dispersive power of a prism.
4. Determination of wavelength of light using diffraction grating-minimum deviation method.
5. Determination of wavelength of light using diffraction grating-normal incidence method.
6. Resolving power of a telescope.
7. Refractive index of a liquid-hallow prism
8. **Determination of thickness of a thin wire by wedge**

II Year B.Sc.-Physics: III Semester

Course-III: HEAT AND THERMODYNAMICS

UNIT-I: Kinetic Theory of gases: (12 hrs)

Kinetic Theory of gases-Introduction, Maxwell's law of distribution of molecular velocities (qualitative treatment only) and its experimental verification,Mean free path, Degrees offreedom, Principle of equipartition of energy

UNIT-II: Thermodynamics: **(12hrs)**

Introduction- Isothermal and Adiabatic processes, Reversible and irreversible processes Qualitative ideas only), Transport pheno Thermal conductivity and its identity with perfect gas scale, Second law of thermodynamics: Kelvin's and Clausius statements, Principle of refrigeration, Entropy, Physical significance, Change in entropy in reversible and irreversible processes; Entropy and disorder-Entropy of Universe; Temperature-Entropy (T-S) diagram and its uses ; change of entropy when ice changes into steam.

UNIT-III: Thermodynamic Potentials and Maxwell's equations: (12hrs) Thermodynamic potentials-Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy and their significance, Derivation of Maxwell's thermodynamic relations from thermodynamic potentials, Applications to (i) Clausius-Clayperon's equation (ii) Value of C_P- C_V (iii) Value of C_P/C_V (iv) Joule- Kelvin coefficient

UNIT-IV: Low temperature Physics: (12hrs)

Methods for producing very low temperatures, Joule Kelvin effect, Porous plug experiment , Joule expansion, Distinction between adiabatic and Joule Thomson expansion, Expression for Joule Thomson cooling, Liquefaction of air by Linde's method, Production of low temperatures by adiabatic demagnetization (qualitative), Practical applications of substances at low temperatures.

UNIT-IV: Low temperature Physics: (12hrs)

Methods for producing very low temperatures, Joule Kelvin effect, Porous plug experiment , Joule expansion, Distinction between adiabatic and Joule Thomson expansion, Expression for Joule Thomson cooling, Liquefaction of air by Linde's method, Production of low temperatures by adiabatic demagnetization (qualitative), Practical applications of substances at low temperatures

6 experiments to be done and recorded

1. Specific heat of a liquid –Joule's calorimeter –Barton's radiation correction
2. Thermal conductivity of bad conductor-Lee's method
3. Thermal conductivity of rubber.
4. Measurement of Stefan's constant.
5. Specific heat of a liquid by applying Newton's law of cooling correction.

   Heating efficiency of electrical kettle with varying voltages.

6.Measurement of Stefan's constant- emissive method

II Year B.Sc.-Physics: IV Semester

Course-IV: ELECTRICITY, MAGNETISM AND ELECTRONICS

UNIT-I

1. Electrostatics: (6hrs)

Gauss's law-Statement and its proof, Electric field intensity due to (i) uniformly charged solid sphere and (ii) an infinite conducting sheet of charge, Deduction of Coulomb's law from Gauss law, Electrical potential–Equipotential surfaces, Potential due to a (i) dipole (ii)uniformly charged sphere

2.Dielectrics: (6 hrs)

Dielectrics-Polar and Non-polar dielectrics- Effect of electric field on dielectrics,Dielectric strength, Capacitance of a parallel plate condenser with dielectric slab between the plates, Electric displacement D, electric polarization P,Relation between D, E and P, Dielectric constant and electric susceptibility.

UNIT-II

1.Magnetostatics: (6 hrs)

Biot-Savart's law and its applications: (i) circular loop and (ii) solenoid, Divergence and curl of magnetic field, Ampere's Circuital Law and its application to Solenoid,Hall effect, determination of Hall coefficient and applications.

2.Electromagnetic Induction: (6 hrs)

Faraday's laws of electromagnetic induction, Lenz's law,Self induction and Mutual induction, Self inductance of a long solenoid, Mutual inductance of two coils, Energy stored in magnetic field, Eddy currents and Electromagnetic damping

UNIT-III

1.Alternating currents: (6 hrs)

Alternating current - Relation between current and voltage in LR and CR circuits,Phasor and Vector diagrams, LCR series and parallel resonant circuit, Q –factor, Power in ac circuits, Power factor.

2.Electromagnetic waves-Maxwell's equations: (6 hrs)

Idea of displacement current,Maxwell's equations-Derivation, Maxwell's wave equation (with derivation), Transverse nature of electromagnetic waves, Poynting theorem (Statement and proof)

UNIT-IV

1. Basic Electronic devices: (12 hrs)

PN junction diode, Zenerdiode andLight Emitting Diode (LED) and their I-V characteristics, Zener diode as a regulator- Transistors and its operation, CB, CE and CC configurations, Input and output characteristicsofa transistor in CE mode, Relation between alpha, beta and gamma; Hybrid parameters, Determination of hybrid parameters from transistor characteristics; Transistor as an amplifier.

UNIT-V:

Digital Electronics: (12 hrs)

Number systems, Conversion of binary to decimal system and vice versa, Binary addition & Binary subtraction (1's and 2's complement methods), Laws of Boolean algebra, DeMorgan's laws-Statements and Proofs, Basic logic gates, NAND and NOR as universal gates, Exclusive-OR gate, Half adder and Full adder circuits

REFERENCE BOOKS

- Electricity and Magnetism, R.Murugeshan, S. Chand & Co.
- Principles of Electronics, V.K. Mehta, S.Chand& Co.,
- Digital Principles and Applications, A.P. Malvino and D.P.Leach, McGrawHill Edition.

- 6 experiments to be done and recorded

1. LCR circuit series/parallel resonance, Q factor.
2. Determination of ac-frequency –Sonometer

3.PN Junction Diode Characteristics

4Zener Diode –V-I Characteristics

5 . Zener Diode as a voltage regulator

6 Logic Gates- OR,AND,NOT and NAND gates. Verification of Truth Tables.

7 Verification of De Morgan's Theorems.

8 Construction of Half adder and Full adders-Verification of truth tables

II B.Sc.-Physics: IV Semester

Course V: MODERN PHYSICS

UNIT-I :

1. Atomic and Molecular Physics:(12 hrs)

Vector atom model and Stern-Gerlach experiment, Quantum numbers associated with it, Angular momentum of the atom, Coupling schemes, Spectral terms and spectral notations, Selection rules, Intensity rules, Fine structure of Sodium D-lines, Zeeman effect,Experimental arrangement to study Zeeman effect;Raman effect Experimental arrangement to study Raman effect, Quantum theory of Ramaneffect,Applications of Raman effect.

UNIT-II:

1. Matter waves&Uncertainty Principle: (12 hrs)

Matter waves, de Broglie's hypothesis, Wave length of matter waves, Properties of matter waves, Davisson and Germer's experiment, Phase and group velocities, Heisenberg's uncertainty principle for position and momentum& energy and time, Illustration of uncertainty principle using diffraction of beam of electrons (Diffraction by a single slit)and photons(Gamma ray microscope),Bohr's principle of complementarity.

UNIT-III:

1. Quantum (Wave) Mechanics:(12 hrs)

Basic postulates of quantum mechanics, Schrodinger time independent and time dependent wave equations-Derivations, Physical interpretation of wave function, Eigen functions, Eigen values, Application of Schrodinger wave equation to (i) one dimensional potential box of infinite height(InfinitePotential Well) and (ii) one dimensional harmonic oscillator

UNIT-IV:

1. Nuclear Physics:(12 hrs)

Nuclear Structure:General Properties of Nuclei, Mass defect, Binding energy; *Nuclear forces*: Characteristics of nuclear forces- Yukawa's meson theory; *Nuclear Models*: Liquid drop model, The Shell model, Magic numbers; *Nuclear Radiation detectors*: G.M. Counter, Cloud chamber, Solid State detector; *Elementary Particles*: Elementary Particles and their classification

UNIT-V:

1. Nano materials:(7hrs)

Nanomaterials – Introduction, Electron confinement, Size effect, Surface to volume ratio, Classification of nano materials– (0D, 1D, 2D); Quantum dots, Nano wires, Fullerene, CNT, Graphene(Mention of structures and properties),Distinct properties of nano materials (Mention-*mechanical,optical, electrical, and magnetic properties*); Mention of applications

nano materials: (*Fuel cells,Phosphors for HD TV, Next Generation Computer chips, elimination of pollutants, sensors*)

2. Superconductivity: (5 hrs)

Introduction to Superconductivity, Experimental results-critical temperature, critical magnetic field, Meissner effect , Isotope effect,Type I and Type II superconductors, BCS theory (elementary ideas only),Applications of superconductors

REFERENCE BOOKS

- BSc Physics, Vol.4, Telugu Akademy, Hyderabad
- Atomic Physics by J.B. Rajam; S.Chand& Co.,

Practical Course V:Modern Physics

1. e/m of an electron by Thomson method.
2. Determination of Planck's Constant (photocell).
3. Verification of inverse square law of light using photovoltaic cell.
4. Determination of the Planck's constant using LEDs of at least 4 different colours.
5. **Determination of work function of material of filament of directly heated Vaccum tube**

III B.SC SEMESTER V-PHYSICS

COURSE VI:PAPER VI (A)-LOW TEMPERATURE PHYSICS AND REFRIGRATION

UNIT 1PRODUCTION OF LOW TEMPERATURES

Introduction,Freezing mixtures,Joule Thomson Effect,Regenerative cooling.Different methods of Liquifaction of gases,Liquification of Air,Production of Liquid Hydrogen and Nitrogen,Adiabatic Demagnetisation,Properties of materials at low temperatures ,Super Conductivity

UNIT II MEASUREMENT OF LOW TEMPERATURES

Gas thermometer and its correction and calibration, secondary Thermometers,Resistance Thermometers,Thermocouples,Vapour Pressure Thermometers,Magnetic Thermometers,Thermocouples,Vapour Pressure Thermometers,Magnetic Thermometers,Advantages and Disadvantages of each Thermometer

UNIT III PRINCIPLES OF REFRIGRATION

Introduction to Refrigration-Natural and Artificial Refrigration,Stages of Refrigration,Types of Refrigration,Vapour compression and Vapour Absorption Refrigration systems.Refrigration cycle and explanation with Block Diagram,Introductary Ideas on Air Conditioning.

Refrigrants-Introduction,Ideal RefrigrantProperties of Refrigrant,Classification of Refrigrants,Commonly used Refrigrants,Eco Friendly Refrigrants.

UNIT IV-COMPONENTS OF REFRIGRATOR

Refrigrator and its working,Block Diagram,Coefficient of Performance(COP),Tons of Refrigration(TR),and Energy Efficiency Ratio(EER),Refrigrator Components,Types of Compressors,Evaprators,Condensors,and their functional Aspects,Defrosting in a Refrigrator,Refrigrent Leakage and Detection.

UNIT V-APPLICATIONS OF LOW TEMPERATURE AND REFRIGRATION

Applications of Low Temperatures:Preservation Of Biological material,Food Freezing,Liquid Nitrogen and Liquid Hydrogen in Medical Field,SUPER CONDUCTING Magnets in MRI Tissu Ablation,Crogenic Rocket Propulsion System.

Application of Refrigration:Domestic Refrigrators,Water Coolers Cold Storages,Ice Plants,Food Preservation Methods,Chemical and Process Industries,Cold Treatm ent of Metals,Construction field,Desalination of water,Data Centers.

REFERAENCE BOOKS

1Heat and Thrmodynamics by Brij Lal & N.Subrramanyam,S.Chand Publishers.

2.Thermal Engineering by S.Singh S.Pati,Ch:18 Introduction to Refrigration

PRACTICAL SYLLABUS

1.Record the principals and Applications of Refrigrations

2. Measure the Temperatures ofbelow Melting Poit of Ice using a Thermometer

3.Making aFreezing Mixture by adding salt Sodium Chloride.

4.Study the operation of a Refrigrator and understand the working of Different Parts.

Study the properties of RefrigrantChlofloroCarbons.Consider a simple Faulty refrigerator and Try to Simple shoot the Problems by Understanding its working.

SEMESTER V

COURSE 7B: SOLAR ENERGY AND APPLICATIONS

UNIT I:BASIC CONCEPTS OF SOLAR ENERGY

Spectral Distribution of Solar Radiation,Solar Constant ,Zenith Angle and Air Mass ,Standard Time,Local Apparent Time,Equation of Time,Direct Diffuse and Total Radiations Pyrheliometer-Woking principle,Direct Radiation Measurement,Pyrometer-working principle, Diffuse Radiation Measurement ,Distinction between Two Meters.

UNIT II:SOLAR THERMAL COLLECTORS

Solar Thermal Collectors:Introduction,Types of Thermal Collectors, Flat Plate Collector,Liquid Heating Type Energy Balance Equation and Efficiency,Evacuated Tube Collector, over all heat loss Coefficient, Definitions of Collector Efficiency Factor and Collector heat Removal Factor and Collector flow Factor,Testing of Flat Plate Collector,Solar water heating system, Natural and Forced circulation Types

Concentrationg Collectors,,Solar Cookers,Solar Dryers,Solar Deslinators.

UNIT III : FUNDAMENTALS OF SOLARCELLS

Semi Condutor Interface,Types Homojunction,Hetero Junction and Schottky Barrier,Advantages and Drawbacks, PhotoVoltaic Cell Equivalent circuit Output Parameters,Conversion Efficiency Quantum Efficiency,Measurement of I-V Characterstics,Series and Shunt Resistance their Effect on Efficiency, Effect of Light Intensity,Inclination and Temperature on Efficiency

UNIT IV:TYPES OF SOLARCELLS AND MODULES

Types of Solarcells,Crystalline Silicon Solar Cells,I-V Characteristics,Poly Si Cells,Amorphous Silicon Cells,Thin Film Solar Cells,CdTe/CdS and CuIn GaSe2/CdS cell configurations,structures,advantages and Limitations,Multijunction Cells_Double and Triple Junction Cells,Module Fabrication Steps,Modules in series and parallel,ByPass and Blocking Diodes.

UNIT V:SOLAR PHOTOVOLTAIC SYSTEMS

Energy Storage in PV Systems,Energy Storage Modes,Electrochemical Storage,Batteries,Primary and Secondary,Solid State Battery,Molten Solvant Battery,Lead Acid Batteryand Dry Batteries,Mechanical Storage-Flywheel,Electrical Storage-Super Capacitor.

PRACTICAL SYLLABUS:

1.Measurement of DirectRadiation using Pyrheliometer

2.Measurement of Global and Diffuse Radiation using Pyranometer

3.Evaluation of Performance of Flat Plate Collector

4.Evaluation of Solarcell by studying the I-V Measurements.

5.Study the Effect of Input Intensity o the Performance of Solar Cell

6.Study the Effect of Cell Inclination on the Efficiency.