Bharatiya Vidya Bhavan

BHAVAN'S VIVEKANANDA COLLEGE

of Science, Humanities And Commerce, Sainikpuri
Autonomous College | Affiliated to Osmania University
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Syllabus - B Sc I Year Physics
W.e.f the academic year: 2020-21

Semester I Course Name: **Mechanics-Course Code: PH 123** (60 Hours)

HPW: 4 **CREDITS: 4**

COURSE OBJECTIVES: This course is designed

COB1: *To illustrate applications of vector differentiation, integration*

COB2: *To describe motion associated with variable mass system and rigid bodies.*

COB3: *To interpret the laws of planetary motion*

COB4: *To infer the concept of relativity.*

Unit – I **15 Hours**

1. **Vector Analysis**
   Scalar and vector fields, gradient of a scalar field and its physical significance. Divergence and Curl of a vector field and related problems. Vector integration- line, surface and volume integrals. Stokes, Gauss, and Green's theorems – simple applications.

Unit – II **15 Hours**

2. **Motion of variable mass system (7)**
   Laws of Motion-Motion of variable mass system, motion of a rocket, multi- stage rocket, conservation of energy and momentum.

3. **Mechanics of rigid bodies (8)**
   Definition of Rigid body. Rotational kinematic relations, equation of motion for a rotating body, angular momentum and inertia tensor. Euler's equations, torque free motion of a symmetric top. Symmetric top and processional motion, Gyroscope.

Unit – III **15 Hours**

4. **Central forces [15]**
   Central forces – definition and examples, conservative nature of central forces, force as a negative gradient of potential energy, center of mass of many body system, two body problem, equation of motion under a central force, gravitation potential and gravitational field, Kepler's Laws-Derivation,

Unit – IV **15 Hours**

5. **Frames of reference and transformation (8)**
   Frames of reference- inertial and non-inertial, Galilean transformation equations, Galilean Invariance, absolute frame of reference, Michelson – Morley experiment- significance of negative result.

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6. **Consequences of relativistic transformations (7)**
Postulates of special theory of relativity, Lorentz transformation, time dilation, length contraction, addition of velocities, mass – energy relation. Concept of four vector formalism and their transformations.

Note: Problems should be solved at the end every chapter of all the units.

COURSE OUT COMES: **By the end of this course, the student will be able to**

CO1: *Use the concepts of vector differentiation, integration and remember impact of variation of mass in motion.*

CO2: *Remember various types of rigid body motion.*

CO3: *Outline concepts of central forces.*

CO4: *Outline the concept of relativity.*

Text books:

1. First year Physics – *Telugu Academy*
2. Mechanics, D S Mathur, S Chand and company Limited,
3. Mechanics of Particles, Waves and Oscillations. Anwar Kamal, *New Age International*
4. Mechanics of Particles, Waves and Oscillations. Dr S L Gupta and Sanjeev Gupta, *Jai Prakash Nath Publications*
5. Mechanics by H S HANS and S P PURI, *Tata-McGraw Hill Company Edition, 2008.*
6. College Physics – I. T. Bhimasankaram and G. Prasad *Himalaya Publishing House.*

Reference Books:

1. Fundamentals of Physics. Halliday/Resnick/Walker *Wiley India Edition 2007.*
2. Berkeley Physics Course Vol.1, Mechanics by C. Kittel, M.A. Ruderman – *Tata McGraw hill Company Edition 2008.*
3. University Physics by Young and Freeman, *Pearson Edition, Edition 2005.*
4. Sears and Zemansky's University Physics by Hugh D. Young, Roger A. *Freedman Pearson Education Eleventh Edition.*
5. An Introduction to Mechanics by Daniel Kleppner & Robert Kolenkow. *The McGrawHill Companies.*
6. Engineering Physics. R.K. Gaur & S.L. Gupta. *Dhanpat Rai Publications.*

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Syllabus - B Sc I Year Physics
W.e.f the academic year: 2020-21

Semester II-Course Name**: Thermal Physics-Course Code: PH 223** (60 Hours)

HPW: 4 **CREDITS: 4**

Course Objectives: ***This course is designed***

COB1: *To define the Laws of Thermodynamics*

COB2: *To relate Laws of Thermodynamics in various applications*

COB3: *To discuss various laws of Black body radiations and its applications*

COB4: *To understand the phenomenon of kinetic theory of gases and statistical mechanics*

Unit I **15 hours**

1. Thermodynamics (8)

Basics of thermodynamics- Isothermal and Adiabatic processes – Work done and relation between the specific heats. Reversible and Irreversible processes. Carnot's Engine and its efficiency. Kelvin's and Claussius statements, Thermodynamic scale of temperature.

2. Entropy (7)

physical significance. Change in entropy in reversible and irreversible processes, Entropy and disorder, Entropy of Universe, Temperature-Entropy (T-S) diagram. Change of entropy of a perfect gas and change of entropy when ice changes into steam.

Unit II **15 hours**

3. Thermodynamic potentials and Maxwell's equations (8)

Thermodynamic Potentials: Definitions, properties and applications. First and Second order Phase Transitions. Derivation of Maxwell's thermodynamic Relations and their applications, Maxwell's Relations: (1) Clausius-Clapeyron's equation, (2) Value of C_p-C_v, (3) TdS Equations. Joule Kelvin effect: Expression for Joule Kelvin coefficient for perfect and Vander Waal's gas.

4. Low temperature Physics (7)

Methods of Production of low temperatures-Joule Thomson's porous plug Experiment. Distinction between Joule's, Adiabatic and Joule Thomson's Expansion processes. Liquefaction of gases: liquefaction of hydrogen and Helium-Adiabatic Demagnetization. Principle of Refrigeration, Vapor Compression Machine.

Unit III **15 hours**

5. Radiation Laws (9)

Black body: Ferry's black body, distribution of energy in the spectrum of Black body. Stefan's law, Wien's displacement law (qualitative), Wien's law and Rayleigh-Jean's law. Quantum theory of Radiation: Planck's law, deduction of Wien's law, Rayleigh-Jeans law and Stefan's law from Planck's law. Determination of Stefan's constant.

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6. Measurement of Radiation (6)

Pyrometers: Types of pyrometers. Disappearing filament optical pyrometer. Angstrom Pyro heliometer and determination of solar constant. Estimation of temperature of sun.

Unit IV **15 hours**

7. Kinetic theory of gases (7)

Elements of Kinetic theory of gases: Mean free path and degrees of freedom. Law of Equipartition of energy and its application to specific heat of mono and diatomic gases. Equation of State: Ideal and Vander waal's gases. Distribution of velocities: Derivation of Maxwell's law of distribution of speeds in ideal gas and its experimental verification. Speed distribution curves. Transport phenomena: Viscosity, Thermal conduction and diffusion.

8. Statistical Mechanics (8)

Introduction to Statistical Mechanics: Concept of ensembles and phase space. Distribution and Statistical equilibrium. Concept of probability: Distribution function and probability theorems. Maxwell Boltzmann's distribution law: Molecular energies in ideal gas. Quantum statistics: Bose Einstein's Distribution law and Fermi Dirac distribution law. Comparison of three statistics.

Course Outcomes: ***By the end of this course, the student will be able***

CO1: *To recognize the importance of the Laws of Thermodynamics*

CO2: *To apply the concepts of Maxwell's relations in various applications*

CO3: *To understand the Laws of Radiation*

CO4: *To differentiate between Transport phenomenon, classical – quantum statistics*

Textbooks:

1. Second Year Physics, *Telugu Academy.*
2. Heat and Thermodynamics, Brijlal and Subrahamanyam (*S.Chand*)
3. Heat and Thermodynamics, D.S. Mathur, *S.Chand & Company Ltd.*
4. Heat and Thermodynamics, Mark W Zemansky, *The McGraw-Hill companies*
5. Thermodynamics, R.C. Srivastava, Subit K. Saha & Abhay K. *Jain Eastern Economy Edition.*
6. Fundamentals of Physics, Halliday/ Resnick /Walker.*C. Wiley India Edition 2007.*

Reference Books:

1. Statistical Physics, F. Reif. *The McGraw- Hill Companies.*
2. University Physics, Young and Freeman, *Pearson Edition, Edition 2005.*
3. Engineering Physics, Uma Mukherji, *Narosa Publishing house.*
4. Feynman's Lectures on Physics Vol. 1, 2, 3 & 4. *Narosa Publications.*
5. Modern Engineering Physics, A.S. Vasudeva. *S.Chand & Co. Publications.*

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Syllabus-B Sc II Year PHYSICS

(To be implemented for students admitted from 2020-21 onwards)

Semester III - Course Code: PH 323 -ELECTROMAGNETIC THEORY

TOTAL HOURS: 60 **HPW: 4** **CREDITS: 4**

COURSE OBJECTIVE: *The aim of this course is designed*

*COB1: To **infer** the concepts of Electrostatics.*

*COB2: To **interpret** the concepts of Magnetostatics.*

COB3: To understand the concepts of Electromagnetic induction and properties of electromagnetic waves

COB4: To analyze phase relation between current and voltage in R, L, C & their combinations and the implications

Unit I **(15 hrs)**

1. Electrostatics

Electric field- Concepts of electric field lines and electric flux, Gauss law (Integral and differential form), application to linear, plane and spherical charge distributions. Conservative nature of electric field, Irrotational field. Electric potential- Concepts of electric potential relation between electric potential and electric field, potential energy of a system of charges. Energy density in an electric field. Calculation of potential from electric field for a spherical charge distribution

Unit II **(15 hrs)**

2. Magnetostatics:

Concept of magnetic field and magnetic flux, Biot–Savart's law, magnetic field induction (B) due to a straight current carrying conductor, Force on a point charge in a magnetic field. Properties of magnetic field induction B, curl and divergence of B, solenoid field. Integral form of Ampere's Law, Applications of Ampere's Law, field due to straight, circular and solenoidal currents. Energy stored in magnetic field. Magnetic energy in terms of current and inductance. Magnetic force between two current carrying conductors. Magnetic field Intensity. Ballistic Galvanometer-Torque on current loop in a uniform magnetic field, working principle of B.G., current and charge sensitivity, electromagnetic damping, critical damping resistance

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Unit III **(15hrs)**

3. **Electromagnetic induction and Electromagnetic waves**
Faraday's law of induction (differential and integral form) –Lenz's law – self and mutual inductance, Continuity equation, modification of Ampere's Law, displacement current Maxwell's equations: Integral and differential form, Maxwell's equations in vacuum and dielectric medium, boundary conditions, Plane wave equation, Transverse nature of electromagnetic waves. velocity of light in vacuum and in medium. Poynting theorem.

Unit IV **(15hrs)**

4. **Varying and alternating currents (15)**
Growth and decay of current/charge in LR, CR and LCR circuits. Critical damping. Alternating current relation between current and voltage in pure R, C, L, RL, RC and RLC vector diagrams, Power in ac circuits. LCR series and parallel resonant circuit – Q-factor. AC & DC motors-single phase, three phase (basics only).

COURSE OUTCOME

By the end of this course, the student will be able

CO1: *To become cognizant of basics of Electrostatics*

CO2: *To **explain** various concepts of Magnetism*

CO3: *To recognize the importance of EMI*

CO4: *To **compare** phase relation between current and voltage in R, L, C & their combinations*

Electromagnetic theory Lab III semester –PH 323P

TOTAL HOURS: 30 **HPW: 2** **CREDITS: 1**

COURSE OBJECTIVE: The aim of this course is designed

COB1: To develop hands on experience on electromagnetic related experiments.

COB2: To provide insights AC response in L C R circuits.

1. To determine the (a) current sensitivity, (b) charge sensitivity, and (c) Critical Damping Resistance CDR of a B.G.
2. Figure of merit and Voltage sensitivity of a moving coil galvanometer.
3. Conversion of moving coil galvanometer into voltmeter and ammeter.
4. To draw the B-H curve of transformer core and determine magnetic constants & energy loss.
5. To variation of magnetic field in a solenoid with current, number of turns and distance using Gauss probe.
6. To study the variation of magnetic field with distance along the axis of a circular coil/Solenoid carrying current by Stewart and Gee's method.

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7. Determination of frequency AC source using Sonometer.
8. RC circuit- Determination of time constant
9. LCR series circuit- Determination of resonant frequency and Q-factor
10. LCR parallel circuit- Determination of resonant frequency and Q-factor

COURSE OUTCOMEs: By the end of this course, the student will be able

COB1: To understand concepts of electromagnetism through electromagnetic related experiments.

COB2: To infer AC response in L C R circuits.

Textbooks

1. Third year Physics – *Telugu Akademy*
2. Electricity and Magnetism – D.N. Vasudeva. *S. Chand & Co.*
3. Electricity and Magnetism by A S Mahajan, A. Rangwala, *Tata Mc.Graw-Hill Education.*
4. Electricity and Magnetism Brijlal and Subramanyam, *Ratan Prakashan Mandir*
5. Berkeley Physics Course–Vol.II - Electricity and Magnetism–Edward M Purcell –*The McGraw-Hill Companies.*
6. Fundamentals of electricity and magnetism By Arthur F. Kip (McGraw-Hill, 1968)
7. Electricity and magnetism by J. H. Fewkes & John Yarwood. Vol. I (Oxford Univ. Press, 1991).
8. Introduction to Electrodynamics, 3rd edition, by David J. Griffiths, (Benjamin Cummings, 1998).
9. Electricity and magnetism. By D C Tayal (Himalaya Publishing House,1988)
10. Electromagnetics by Joseph A. Edminister 2nd ed.(New Delhi: Tata McGraw Hill, 2006)
11. B.Sc Practical Physics by C L Arora, *S.CHAND & Company Ltd.*
12. B.Sc Practical Physics by Harnam Singh Dr P S Hemne *S.CHAND & Company Ltd.*
13. B. L. Worsnop and H. T. Flint Advanced Practical Physics, Asia Publishing House, New Delhi.
14. Indu Prakash and Ramakrishna, A Text Book of Practical Physics, Kitab Mahal

Reference Books

1. Electricity and Electronics, D.C. Tayal, *Himalaya Publishing House.*
2. Electricity and Magnetism, C.J.Smith, *Edward Arnold Ltd.*
3. Electricity, Magnetism with Electronics, K K Tewari. *S.Chand & Co.*
4. General Physics by Douglass C Giancoli, *Prentice-Hall, Inc, New Jersey.*
5. Introduction to Physics for Scientists and Engineers. F.J Ruche. *McGraw Hill.*

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Syllabus-B Sc II Year PHYSICS

Semester IV – Course Code: PH 423 -WAVES and OPTICS

HPW: 4 **60 hours** **CREDITS: 4**

COURSE OBJECTIVES:

The course is designed:

COB1: To explain the fundamental concepts of waves in strings and bars.

COB2: To understand the concept of interference.

COB3: To infer the concept of diffraction.

COB4: To describe methods of polarization and its applications.

Unit I **15 hrs**

1. Waves -Fundamentals of Waves

Transverse wave propagation along a stretched string, general solution of wave equation and its significance, Expression for velocity, modes of vibration of stretched string clamped at both ends, overtones, energy transport, transverse impedance.

Longitudinal vibrations in bars – wave equation and its general solution. Expression for velocity. Special cases (i) bar fixed at both ends ii) bar fixed at the mid point iii) bar free at both ends iv) bar fixed at one end, free at other end.

Unit – II **15 hrs**

2. Interference:

Principle of superposition: Coherence, temporal and spatial coherence, conditions for Interference of light

Interference by division of wave front: Young's double slit experiment, Theory of interference. Fresnel's Bi-prism: Determination of wave length of light, determination of thickness of a transparent material using Bi-prism. Change of phase on reflection, Lloyd's mirror experiment.

Interference by division of amplitude:

Oblique incidence of a plane wave on a thin film due to reflected and transmitted light (Cosine law), Colors of thin films. Non reflecting films, interference by a plane parallel film illuminated by a point source. Interference by a film with two non-parallel reflecting surfaces: Wedge shaped film, determination of diameter of wire. Newton's rings in reflected light with and without contact between lens and glass plate, Newton's rings in transmitted light Determination of wave length of monochromatic light. Michelson's Interferometer: Types of fringes, Determination of wavelength of monochromatic light, Difference in wavelength of sodium D1, D2 lines and thickness of a thin transparent plate.

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15 hrs

Unit III

3. Diffraction:

Introduction: Distinction between Fresnel and Fraunhoffer diffraction. Fraunhoffer diffraction: Diffraction due to single slit and circular aperture, Limit of resolution. Fraunhoffer diffraction due to double slit, Fraunhoffer diffraction pattern with N slits (diffraction grating). Resolving Power of grating-derivation. Determination of wave length of light in normal and oblique incidence methods by using diffraction grating.

Fresnel diffraction: Fresnel's half period zones, area of the half period zones. zone plate – Comparison of zone plate with convex lens, Phase reversal zone plate. Diffraction at a straight edge. Distinction between interference and diffraction.

15 Hrs

Unit – IV

4. Polarization:

Polarized light: Methods of Polarization, Polarization by reflection, refraction, Double refraction, selective absorption. Scattering of light, Brewster's law, Malus law, Nicol prism: polarizer, analyzer. Refraction of plane wave incident on negative and positive crystals-Huygen's explanation. Quarter wave plate and half wave plate. Babinet's compensator: Optical activity. Laurent's half shade polarimeter-Analysis of light.

COURSE OUT COME

By the end of the course, the student will be able:

CO1: To apply the concepts of waves in various applications.

CO2: To use the acquired information about interference.

CO3: To Outline the concept of diffraction.

CO4: To get an insight into concepts polarized light.

Waves and Optics Lab Semester IV- PH 423P

HPW: 2 **30 hours** **CREDITS: 1**

COURSE OBJECTIVE: The aim of this course is designed

COB1: To develop hands on experience in experiments based on interference, diffraction and polarization.

COB2: To provide insights into concepts of waves and oscillation in strings.

1. Determination of refractive index of a glass and liquid (Boys Method).
2. To obtain the Refractive index of the material of the prism by determining the angle of minimum deviation from I-D curve.
3. Determination of dispersive power of a prism.
4. Determination of thickness of a wire-wedge method.
5. Determination of Radius of curvature of a given convex lens- Newton's rings.
6. Determination of wavelength of light using diffraction grating minimum deviation method.
7. Wavelength of light using diffraction grating – normal incidence method.
8. Determination of wavelength of a given Laser light using diffraction grating.
9. Study of optical rotation using polarimeter.
10. Verification of Laws of a stretched string (Three Laws).
11. Velocity of Transverse wave along a stretched string
12. Determination of frequency of a bar- Melde"s experiment

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COURSE OUTCOME: *By the end of this course, the student will be able*

CO1: To understand concepts of interference, diffraction and polarization through related experiments.

CO2: To interpret wave propagation in strings.

Textbooks

1. Second Year Physics – Telugu Academy
2. Optics, Ajoy Ghatak. The McGraw-Hill companies.
3. Optics, Subramanyam and Brijlal. S. Chand & Co.
4. Optics and Spectroscopy, R. Murugeshan and Kiruthiga Siva Prasath. S. Chand & Co.
5. Fundamentals of Optics, Jenkins A. Francis and White E. Harvey, McGraw Hil Inc.
6. Fundamentals of Physics, Halliday/Resnick/Walker.C. Wiley India Edition 2007.
7. B.SC Practical Physics, C L Arora, S.CHAND & Company Ltd.
8. B.SC Practical Physics, Harnam Singh Dr P S Hemne, S.CHAND & Company Ltd.
9. B.Sc First year Physics – Telugu Akademi.
10. Waves and Oscillations - N. Subramaniyam and Brijlal Vikas Publishing House Private Ltd.
11. Waves and Oscillations - S. Badami, V. Balasubramanian and K. Rama Reddy Orient Longman.
12. The Physics of Waves and Oscillations - N K Bajaj, Tata-McGraw Hill Company Edition, 2008.

Reference Books

1. Optics, Eugene Hecht and A R Ganesan, *Pearson Education India*
2. Understanding optics, M K Sinha *Tata Macgraw Hill Education Pvt. Lmt.*
3. Sears and Zemansky's University Physics, Hugh D. Young, Roger A. Freedman. *Pearson Education Eleventh Edition.*
4. Fundamentals of Physics- An Introduction, Sanat Kumar Chatterjee, *Narosa Publications.*
5. Feynman's Lectures on Physics Vol. 1,2,3 & 4. *Narosa Publications.*
6. Physics Laboratory Manual, David H Loyd, *Brooks/cole Ceneage Learning.*
7. The Physics of Vibrations and Waves by H. J. Pain, John Wiley and Sons
8. Fundamentals of Physics by Alan Giambattista et al *Tata-McGraw Hill Company Edition, 2008.*

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Syllabus - B Sc III Year Physics
W.e.f the academic year: 2022-23

Semester V - Course Name: **Modern Physics** – Course Code: **PH523A (60 hours)**
(DSE)

HPW: 4 **CREDITS: 4**

COURSE OBJECTIVES: *The aim of this course is designed*

COB1: *To introduce the concept of dual nature of light and matter leading to the incorporation of particle properties of matter into wave equation and also explain the application of Schrodinger wave equation to evaluate the expectation values*

COB2: *To introduce the basic crystal structures, Diffraction of x-rays by crystals and explain the characteristics of crystals based on the type of bonding*

COB3: *To introduce the nuclear structure and models with an emphasis on Binding energy and explain the process of alpha and beta decay and the working principle of certain counters*

COB4: *To introduce to the students the concept of spin and space quantization leading to a new set of quantum numbers and also explain the possible transitions and motions giving rise to Atomic and molecular spectra*

UNIT – I: Quantum Mechanics **20 hours**

1. **Particle properties of wave and Matter waves:**
Inadequacy of classical Physics. Photoelectric effect - Einstein's photoelectric equation. Compton's effect - experimental verification.
De- Broglie's hypothesis: Matter waves, properties of matter waves, Phase and Group velocities. Davisson and Germer experiment, double slit experiment. Consequences of de-Broglie theory.

2. **Uncertainty Principle and Wave Mechanics:**
Heisenberg's uncertainty principle for position and momentum (x & p_x), Energy and time (E& t); Experimental verifications: Gamma ray microscope, Diffraction by a single slit. Applications: Position of electron in a Bohr's orbit.
Schrodinger time independent and time dependent wave equations. Wave function properties and Significance. Basic postulates of quantum mechanics. Expectation values and Normalization of wave function. Applications: Particle in a box.

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14 hours

UNIT - II: Solid State Physics & Crystallography

3. **Crystal Physics and diffraction:**
Amorphous and Crystalline nature of matter, Unit Cell and Space Lattice, Elements of Symmetry, Crystal systems and Bravais lattices, Miller indices, Simple crystal structures: (NaCl and CsCl).
Diffraction of X –rays by crystals: Bragg's law Experimental techniques: Laue's method and powder diffraction method
4. **Bonding in Crystals:**
Types of bonding in crystals: Characteristics of crystals with different bonding, Lattice energy of ionic crystals, Determination of Madelung's Constant for NaCl crystal, Determination of Born's repulsive coefficient and repulsive exponent, Born – Haber cycle

12 hours

Unit - III: Nuclear Physics

5. **Nuclear Structure:** Basic properties of nucleus - size, charge, mass, spin, magnetic dipole moment and electric quadrupole moment, Semi empirical mass formula, Binding energy of nucleus, deuteron binding energy, nuclear forces, Nuclear models- liquid drop model, shell model.
6. **Alpha and Beta Decays:** Range of alpha particles, Geiger - Nuttal law, Gammow's theory of alpha decay, Geiger - Nuttal law from Gammow's theory, Beta spectrum - neutrino hypothesis
Particle Detectors: GM counter, proportional counter, scintillation counter

14 hours

UNIT – IV: Spectroscopy

7. **Atomic Spectra:** Introduction - Drawbacks of Bohr's atomic model - Sommerfeld's orbits -relativistic correction (Qualitative). Stern & Gerlach experiment, Vector atom model. L-S and j-j coupling schemes. Spectral terms, selection rules, intensity rules. Alkali Spectra, doublet fine structure. Zeeman Effect (Classical theory), Paschen-Back Effect and Stark Effect. (Basic idea)
8. **Molecular Spectroscopy:** Types of molecular spectra, pure rotational energies and spectrum of diatomic molecule. Determination of inter nuclear distance. Vibrational-electronic energies and spectrum of diatomic molecule. Raman effect, classical theory of Raman effect. Experimental arrangement for Raman effect and its applications.

Outcome

Having done the course, the student gains sufficient knowledge as to

CO1: *relate the complementary nature of the wave and particle properties of a material particle and evaluate the measurable properties of any given system with a specified potential by applying the Schrödinger's wave equation*

CO2: *study the dependence of various properties of solids on the structure of the crystal and relate the characteristics of crystals with the type of bonding*

CO3: *determine the Binding energy of a given nuclei by gaining an insight to nuclear structure and models and interpret Radioactive decay in terms of quantum mechanical tunnelling*

CO4: *relate the probable interactions between matter and electromagnetic radiation leading to different nuclear reactions*

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Textbooks

1. Concepts of Modern Physics, Arthur Beiser, *Tata McGraw-Hill Edition*
2. Modern Physics, R. Murugeshan and Kiruthiga Siva Prasath. *S. Chand & Co*
3. Third Year Physics - Telugu Academy
4. Introduction to Solid State Physics, Charles Kittel. John *Wiley and Sons.*
5. Solid State Physics, SL Gupta & Kumar V, *K Nath & Co*
6. Molecular Structure and Spectroscopy, G. Aruldhas, *Eastern Economy Edition.*
7. Elements of Solid-State Physics, J.P. Srivastava.
8. Modern Physics, G. Aruldhas & P. Rajagopal. *Eastern Economy Edition.*
9. Nuclear Physics an introduction, S.B. Patil, *Wiley Eastern Limited*
10. Nuclear Physics, D.C. Tayal, *Himalaya Publishing House.*

Reference Books

1. A Text book of Quantum Mechanics, P.M. Mathews & K. Venkatesan, 2nd Ed., 2010, *McGraw Hill*
2. Quantum Mechanics, Robert Eisberg and Robert Resnick, 2ndEdn., 2002, *Wiley.*
3. Quantum Mechanics, Leonard I. Schiff, 3rdEdn. 2010, *Tata McGraw Hill.*
4. Introduction to Quantum Mechanics, David J. Griffith, 2nd Ed. 2005, *Pearson Education*
5. Introduction to Solids by Modern Physics, Leonid V. Azaroff, *Tata McGraw Hill*
6. Modern Physics, G. Aruldhas & P. Rajagopal, *Eastern Economy Edition.*
7. Fundamentals of Molecular Spectroscopy, C.N. Banwel. *Tata McGraw-Hill Edition*
8. Nuclear Physics, Irving Kaplan, *Narosa Publishing House*
9. Nuclear Physics theory and experiment, Roy and Nigam, *New Age Publishers*

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Syllabus-B Sc III Year PHYSICS

W.e.f the academic year: 2022-23

Semester VI- Course Name: Renewable Energy and Energy Harvesting

Course Code: **GE523 (60 Hours)**

Generic Elective

HPW: 4 **CREDITS: 4**

COURSE OBJECTIVES: *The course is designed*

COB1: *to bring awareness regarding the necessity of alternate energy sources.*

COB2: *to impart knowledge about wind and bio-mass energy.*

COB3: *to introduce concepts of solar energy and its applications*

COB4: *to divulge fundamentals of thermal and ocean energy*

UNIT I **15 Hours**

Non-renewable energy and renewable energy resources

Non-renewable energy resources-Principles of power generation and transmission. A model of conventional thermal power plant. Advantages of conventional power plants. Hydro Energy: Hydropower resources, hydropower technologies, environmental impact of hydro power sources.

Fossil fuels and nuclear energy, their limitation. Alternate sources of energy, need of renewable energy, non-conventional energy sources. An overview of developments in Offshore Wind Energy, Tidal Energy, Wave energy systems, Ocean Thermal Energy Conversion, solar energy, biomass, biochemical conversion, biogas generation, geothermal energy tidal energy, Hydroelectricity.

UNIT II **15 Hours**

Wind and Bio mass Energy

Wind Energy harvesting: Fundamentals of Wind energy, Wind Turbines and different electrical machines in wind turbines, Power in wind, electronic interfaces, and grid interconnection topologies.

Principles of Bio Conversion, Energy from waste, types of bio-gas digesters, gas yield, combustion characteristics of bio-gas, utilization for cooking, LPG, and CNG

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UNIT III **15 Hours**

Solar energy storage and its Applications:

Solar energy: Solar energy, its importance, storage of solar energy, solar pond, non-convective solar pond, applications of solar pond and solar energy, solar water heater, flat plate collector, solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning. Need and characteristics of photovoltaic (PV) systems, PV models and equivalent circuits, and sun tracking systems.

UNIT IV **15 Hours**

Geothermal and ocean Energy

Resources, types of wells, methods of harnessing the energy, potential in India. OTEC, principles of utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy, Potential and conversion techniques, mini-hydel power plants, land and their economics.

Carbon captured technologies, cell, batteries, power consumption, Environmental issues and Renewable sources of energy, sustainability.

Course outcome

By the completion of this course, students should

CO1: *understand necessity of alternate energy sources and conservation of conventional energy.*

CO2: *to impart knowledge about wind and bio-mass energy*

CO3: *to know importance of solar energy and its applications*

CO4: *to outline importance of usage of thermal and ocean energy*

Reference Books:

1. Non-conventional energy sources, B.H. Khan, *McGraw Hill*
2. Solar energy, Suhas P Sukhative, Tata McGraw - *Hill Publishing Company Ltd.*
3. Renewable Energy, Power for a sustainable future, Godfrey Boyle, 3rd Edn., 2012, *Oxford University Press.*
4. Solar Energy: Resource Assesment Handbook, P Jayakumar, 2009
5. Photovoltaics, J. Balfour, M. Shaw and S. Jarosek, Lawrence J Goodrich (USA).

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SAINIKPURI

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Syllabus- B Sc III Year PHYSICS

W.e.f the academic year: 2022-23

Semester VI - Course Name: **Electronics** – Course Code: **PH 623A (60 hours)**

HPW: 4 **CREDITS: 4**

COURSE OBJECTIVES: This course is designed

COB1: *To introduce the concepts of classification of Band theory of solids.*

COB2*: To explain the working principles, characteristics of BJT, FET, UJT and SCR and its applications.*

COB3*: To distinguish the conversion methods of various number systems & perform different binary arithmetic operations*

COB4*: To examine the operations of various Logic gates and Combinational circuits*

Unit – I

Band theory of Solids: **15 hours**

Energy bands in Solids (band theory), valence band, conduction band and forbidden energy gap in solids, insulators, Semiconductors - intrinsic semiconductors and extrinsic semiconductors (n-type, p-type), Fermi level, continuity equation.

Diodes: p-n junction diode, Half wave, Full wave rectifiers and Bridge rectifier. Characteristics of Zener diode and its application as voltage regulator.

Unit II **15 hours**

Transistors

pnp and npn transistors, current components in transistors (Two port model), CB, CE and CC configurations, Transistor as an amplifier, RC coupled amplifier- frequency response (Qualitative analysis)

Feedback Concept & Oscillators:

Concept of feedback, Concept of Oscillator, Barkhausen's criteria and Phase Shift Oscillator - Expression for frequency of oscillation.

Unit III

Electronic devices **15 hours**

Construction, working and characteristics: Photo diode-Shockley diode- Solar cell, Opto-couplers. Field Effect Transistor (FET) – FET as an Amplifier- Uni Junction Transistor (UJT), UJT as a relaxation oscillator- Silicon Controlled Rectifier (SCR) – SCR as a switch.

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15 hours

Unit – IV

Digital Electronics

Binary number system: Conversion of Binary to Decimal and vice versa, Binary addition and subtraction (1's and 2's complement methods). Hexadecimal number system. Conversion from Binary to Hexadecimal and vice versa. Decimal to Hexadecimal and vice versa.

Logic gates: OR, AND, NOT gates, truth tables, realization of these gates using discrete components. NAND, NOR as universal gates, Exclusive – OR gate, De Morgan's Laws– Statement and Proof, Half and Full adders.

COURSE OUTCOME: By the end of the course, the student should

CO1: *learn the basics of band theory of solids*

CO2: *understand the working principle, applications of Transistors and concepts of feedback.*

CO3: *be able to comprehend fundamental concepts of FET, UJT and SCR*

CO4: *apply conversion methods of various number systems & perform different binary arithmetic operations and also apply knowledge of various Logic gates and Combinational circuits in various applications*

Textbooks

1. Third year Physics – *Telugu Akademy*
2. Electricity and Electronics – D.C. Tayal, *Himalaya Publishing House.*
3. Electronic devices and circuits, Millman and Halkias. *Mc.Graw-Hill Education.*
4. Principles of Electronics, V K Mehta and Rohit Mehta, *S.CHAND & Company Ltd.*
5. Digital Principles & Applications, A.P.Malvino and D.P. Leach. *McGraw Hill Education.*
6. Digital logic and computer design by Morris Mano, Pearson

Reference Books

1. Fundamentals of Physics by Halliday/Resnick/Walker - *Wiley India Edition 2007.*
2. Electricity, Magnetism with Electronics – K K Tewari. *S.Chand & Co.*
3. General Physics by Douglass C Giancoli, Prentice-Hall, INC, New Jersey.

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Syllabus- B Sc III Year PHYSICS

W.e.f the academic year: 2022-23

Semester VI- Course Name: Nano Science-Course Code: PH 623_O Semester VI (60hrs)

Optional Paper

HPW: 4 **CREDITS: 4**

COURSE OBJECTIVES: *The course is designed*

COB1: to introduce fundamentals of nanostructures.

COB2: to explain physical and chemical synthesis methods.

COB3: to introduce characterization techniques for nanomaterials

COB4: to divulge applications of nanomaterials

Unit I (15 hours)

Length scales in Physics, Nanostructures: 1D 2D 3D nanostructures (nanodots, nanowires, nanorods) Band structure and density of states of materials at nanoscales, Size effects in nano systems, Quantum confinement in 1D 2D 3D nanostructures and its consequences.

Unit II (15 hours)

SYNTHESIS OF NANOSTRUCTURED MATERIALS: Top down and bottom up approach, photolithography, ball milling, gas phase condensation, vacuum deposition, physical vapour deposition (PVD), thermal evaporation, E-beam evaporation, pulsed laser deposition, chemical vapour deposition, Sol-Gel, Electrode position, Spray pyrolysis, hydrothermal synthesis, preparation through colloidal methods, MBE growth of quantum dots.

Unit III (15 hours)

CHARACTERIZATION: X-ray Diffraction, Optical Microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy, Atomic Force Microscopy Scanning Tunnelling Microscopy.

Unit IV (15 hours)

APPLICATIONS: Applications of nanoparticles, Quantum dots, nanowire and thin films for photonic devices (LED, solar cells) Single electron devices (no derivation) CNT based transistors, Nano material devices: Quantum dots heterostructures lasers optical switching and optical data storage, Magnetic Quantum well; magnetic dots-

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magnetic data storage. Micro Electrochemical systems (MEMS) Nano Electromechanical systems (NEMS)

Note: Problems should be solved at the end of every chapter of all units.
Students will be provided hands on experience of at least one synthesis methods

OUT COME

By the completion of this course, students should

CO1: interpret the length scales and hence nano size.

CO2: understand different nano material synthesis methods.

CO3: learn nano material characterization techniques

CO4: recognize importance of nano material applications

Text Books:

1. Introduction to Nanotechnology-Charles P. Poole, Frank J Owens, *Wiley India Pvt. Ltd.*
2. Introduction to Nano Science and Technology- K.K. Chattopadhyay & A.N. Banerjee , *PHI Learning Private Limited*
3. Nanotechnology: Principle and Practices S. K Kulkarni, *Capital Publishing Company*
4. Nanotechnology, Richard Booker, Earl Boysen, *John Wiley and Sons*
5. Handbook of Nanotechnology, Bharat Bhushan, *Springer*
6. Material Characterization Techniques, Sam Zhang, Lin Li, Ashok Kumar, *CRC Press*

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