Bharatiya Vidya Bhavan

BHAVAN'S VIVEKANANDA COLLEGE

of Science, Humanities and Commerce, Sainikpuri
Autonomous College | Affiliated to Osmania University
Reaccredited with 'A' Grade by NAAC

Syllabus - B Sc III Year Physics
W.e.f the academic year: 2025-26

Semester V

Course Name: **Modern Physics** Course Code: **PH523A** (60 hours)

(DSE)

HPW: 4 **CREDITS: 4**

Course Objectives: This course is designed to

COB1*: explain how the dual nature of light and matter integrates particle properties into the wave equation, and apply Schrödinger's equation to evaluate expectation values.*

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

COB3*: analyze the nuclear structure and models with an emphasis on binding energy*

COB4*: relate the concept of spin and space quantization leading to a new set of quantum numbers*

UNIT–I

Quantum Mechanics **(20 hrs)**

Particle properties of wave and Matter waves (10)

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.

Uncertainty Principle and Wave Mechanics (10)

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 (one dimension).

The confluence of Modern Physics and Vedanta: Heisenberg and Schrodinger's Interpretation on close parallelism between Quantum Mechanics and Vedanta. Relativity, consciousness and Intuition - the common basis for Science and Vedanta.

UNIT–II

Solid State Physics & Crystallography **(14 hrs)**

Crystal Physics and diffraction (7)

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.

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Bonding in Crystals (7)

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.

UNIT-III

Nuclear Physics **(12 hrs)**

Nuclear Structure (6)

Basic properties of nucleus - size, charge, mass, spin, magnetic dipole moment and electric quadrupole moment. Homi J Bhabha as the father of Indian Nuclear Physics. Semi empirical mass formula. Binding energy of nucleus, deuteron binding energy, nuclear forces. Nuclear models- liquid drop model, shell model.

Alpha and Beta Decays (6)

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, scintillation counter.

UNIT–IV

Spectroscopy **(14 hrs)**

Atomic Spectra (7)

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)

Molecular Spectroscopy (7)

Types of molecular spectra, pure rotational energies and spectrum of diatomic molecule. Determination of internuclear distance. Vibrational-electronic energies. Sir CV Raman's contributions to experimental Physics. Raman effect, classical theory of Raman effect. Experimental arrangement for Raman effect and its applications.

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

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

CO2: *classify the crystal structures and compare the characteristics of solids based on the type of bonding*

CO3: *estimate the Binding energy of a given nuclei and justify the decay of α particle in terms of quantum mechanical tunnelling*

CO4: *identify 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. B.Sc. Third Year Physics,*Telugu Akademi.*
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.*
11. Modern Physics and Vedanta, Swami Jitatmananda, *Bhavan's Book Series.*

Reference Books:

1. A Text book of Quantum Mechanics, P.M. Mathews & K. Venkatesan, *McGraw Hill 2nd Ed., 2010.*
2. Quantum Mechanics, Robert Eisberg and Robert Resnick, *Wiley 2nd Ed., 2002.*
3. Quantum Mechanics, Leonard I. Schiff, *Tata McGraw Hill 3rd Ed., 2010.*
4. Introduction to Quantum Mechanics, David J. Griffith, *Pearson Education 2nd Ed., 2005.*
5. Introduction to Solids, 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. Banwell. *Tata McGraw-Hill Edition.*
8. Nuclear Physics, Irving Kaplan, *Narosa Publishing House.*
9. Nuclear Physics theory and experiment, Roy and Nigam, *New Age Publishers*
10. Mind and Matter, Erwin Schrodinger, *Cambridge University Press, 1967.*
11. Physics and Philosophy, Werner Heisenberg, *Harper and Row Publisher, 1958.*

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Semester V

Course Name: **Modern Physics Lab (DSE)** Course Code: **PH523AP**

HPW: 2 **CREDITS: 1**

Course Objectives: This course is designed to

COB1: *Perform the experiment and determine certain universal constants such as Planck's constant, Rydberg's constant and Boltzmann's constant and verify their values*

COB2: *Study the characteristics of GM Counter and identify the radioactive particle*

1. Determination of Planck's constant (photocell)
2. Study of photoelectric effect: photo current versus wavelength and intensity of incident light
3. e/m of an electron by Thomson method
4. To study the quantum tunnelling effect with solid state device, e.g. tunnel diode
5. Determination of Boltzmann constants using V-I characteristics of junction diodes.
6. To determine the magnetic field by Hall-probe method
7. To determine the energy gap of a semiconductor
8. To determine the Rydberg's constant using Hydrogen spectra.
9. To determine the absorption lines in the rotational spectrum of Iodine vapour
10. To determine the ionization potential of mercury
11. Characteristics of G M Counter.
12. Study of absorption of β and γ rays using G M Counter
13. To find the half-life period of a given radioactive substance using a G.M. Counter.
14. To determine the Planck's constant using LEDs of at least 4 different colours.
15. To determine the wavelength of laser source using diffraction of single slit

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

CO1: *determine and verify the values of certain Universal Constants and also study and analyse the underlying Physical phenomena observed*

CO2: *identify the Radioactive particle by studying the characteristics of GM Counter and determine the Half- life periods*

Textbooks:

1. B.Sc Practical Physics by C L Arora, *S.Chand & Company Ltd.*
2. B. Sc Practical Physics, Harnam Singh Dr P S Hemne, *S. Chand & Company*
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Ed., 2011, *Kitab Mahal, New Delhi.*

Reference Books:

1. Advanced Practical Physics for students, B.L. Flint & H.T. Worsnop, 1971, *Asia Publishing House.*
2. A laboratory manual for undergraduate classes, D.P. Khandelwal, *Vani Publishing House, New Delhi.*
3. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, *Heinemann Educational Publishers.*

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Syllabus-B Sc III Year PHYSICS

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

Semester V

Course Name: **Computational Physics** Course Code: **PH523B** (60 Hours)

(DSE)

HPW: 4 **CREDITS: 4**

COURSE OBJECTIVE: ***This course is designed to***

COB 1:*introduce to the students the basics of C language programming.*
COB 2:*introduce to the students the concept of numerical methods of analysis*
COB 3: *explain various types of distribution and methods to obtain solutions*
COB 4: *introduce to the students the simple concepts of computational methods*

UNIT I **(15 hrs)**

Programming in C

Flow charts, algorithms, Integer and floating-point arithmetic, precision, Variable types, Arithmetic statements, Input and Output statements, Control statements, Executable and non-executable statements, arrays, Repetitive and logical structures, Subroutines and functions, Operation with files, Operating Systems, Creation of executable programs.

UNIT II **(15 hrs)**

Numerical Methods of Analysis

Solution of algebraic and transcendental equations, Iterative, Bisection and Newton-Raphson methods, Solution of simultaneous linear equations, Matrix inversion method.

Interpolation

Newton and Lagrange formulae, Numerical differentiation, Numerical integration, Trapezoidal, Simpson and Gaussian Quadrature methods, Least square curve fitting, Straight line and Polynomial fits.

UNIT III **(15 hrs)**

Numerical solution of ordinary differential equations: Euler's and Runge-Kutta methods, Simulation

Generation of uniformly distributed random integers, Statistical tests of randomness. Monte-Carlo evaluation of integrals and error analysis, non-uniform probability distributions, Importance of sampling, Rejection method.

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UNIT IV

Computational methods **(15 hrs)**

Metropolis algorithm, Molecular diffusion and Brownian motions as random walk problems and their Monte Carlo simulation.

Finite element and finite difference methods, boundary value and initial value problems, density functional methods.

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

Course Outcomes: ***By the completion of this course, students should be able to***

CO1: *remember the concepts of C language programming*

CO2: *analyze various Numerical methods*

CO3: *distinguish different numerical methods of solutions*

CO4: *understand the concepts of algorithms, Brownian motions etc.*

Recommended Books:

1. Computational methods in Physics and Engineering: Samuel S M Wong, *World Scientific Publishing Company.*
2. Computer Oriented Numerical methods: V. Rajaraman *PHI learning private limited.*
3. Computer Programming in FORTRAN 77: V. Rajaraman, *PHI learning private limited.*
4. Applied Numerical Analysis: Curtis F. Gerald, Patrick O. Wheatley, Addison-*Wesley Publishing Company.*
5. A Guide to Monte Carlo Simulations in Statistical Physics, Landau D. & Binder *Cambridge University Press.*

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Semester V –Course Name: Computational Physics Lab Course Code: **PH523B P (DSE)**

(45 Hours – 15 sessions)

HPW: 3 **CREDIT: 1**

COURSE OBJECTIVES: This course is designed

COB1: *To interpret various numerical techniques, hence augment reasoning and analytical abilities.*

COB2: *To apply numerical techniques in understanding theoretical concepts*

1. Jacobi Method of Matrix diagonalization
2. Solution of Transcendental or Polynomial equations by the Newton Raphson metho
3. Linear curve fitting and calculation of linear correlation coefficients
4. Matrix Simulation: Subtraction and Multiplication.
5. Matrix Inversion and solution of simultaneous equations
6. Lagrange interpolation based on given input data
7. Numerical integration using the Simpson's method.
8. Numerical integration using the Gaussian Quadrature method.
9. Solution of first order Differential Equation using Runge-Kutta method.
10. Numerical first order differentiation of a given function.
11. Fast Fourier transform
12. Monte Carlo Integration
13. Use of a package for data generation and graph plotting.
14. Test of Randomness for random numbers generators.

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

CO1: *acquire skill of interpreting various numerical techniques.*

CO2: *perceive numerical techniques in understanding theoretical concepts*

Note: Minimum of eight experiments should be performed. Maximum of 15 students per batch and maximum of three students per experiment should be allotted in the regular practical class of three hours per week.

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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 to

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

COB2: *impart knowledge about wind and biomass energy.*

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

COB4: *divulge fundamentals of thermal and ocean energy*

Unit-I **(10 hrs)**

Non-renewable energy and renewable energy resources

Non-renewable energy resources-Principles of power generation and transmission. A model of a conventional thermal power plant. Advantages of conventional power plants. Fossil fuels and nuclear energy, their limitations. Introduction to non-conventional energy sources.

HydroEnergy: Hydro power resources, hydro power technologies, environmental impact of hydro power sources.

Unit - II **(15 hrs)**

Wind and Biomass Energy

WindEnergy harvesting: FundamentalsofWindenergy,WindTurbinesanddifferent electrical machines in wind turbines, Power in wind, electronic interfaces,and grid interconnection topologies.

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

Unit - III **(20 hrs)**

Solar energy storage and its Applications

Solar energy: Solarenergy,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 greenhouses,solar cell,absorption air conditioning.Need And Characteristics Of Photovoltaic(PV)systems,PVmodelsand equivalent circuits, and sun tracking systems. Simulations on solar thermal systems.

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Unit - IV **(15 hrs)**

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.

Carboncaptured technologies, cell, batteries, power consumption, Environmental Issues and Renewable Sources of energy, sustainability.

Course Outcomes: ***By the completion of this course, students should***

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

CO2: *impart knowledge about wind and biomass energy*

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

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

ReferenceBooks:

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, GodfreyBoyle, *3rd Ed. 2012, Oxford UniversityPress.*
4. Solar Energy: Resource Assessment Handbook, P Jayakumar, 2009.
5. Photovoltaics, J. Balfour, M.Shaw and S. Jarosek, *Lawrence J Goodrich (USA).*

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Syllabus - B Sc III Year Physics
W.e.f the academic year: 2025-26

Semester VI

Course Name: **Electronics** Course Code: **PH 623A (60 hours)**

HPW: 4 **CREDITS: 4**

Course Objectives: This course is designed to

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

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

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

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

Unit – I

Band theory of Solids (7) **(15 hrs)**

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 (8)

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

Unit II

Transistors (8) **(15 hrs)**

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 (7)

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

Unit III

Electronic devices **(15 hrs)**

Construction, working and characteristics: Photo Electronic Devices - Photodiode, LEDs- 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 controlled rectifier.

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Unit – IV

Digital Electronics

Number system (7) **(15 hrs)**

Acharya Pingala and 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 (8)

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

CO1: *classify the band theory of solids*

CO2: *understand the working principle, applications of Transistors as an amplifier and oscillator with concepts of feedback.*

CO3: *assess the working of devices such as FET, UJT and SCR as an amplifier, oscillator and a switch respectively*

CO4: *inspect the use of Logic gates and Combinational circuits in applications such as Adders*

Textbooks:

1. B.Sc., Third year Physics – *Telugu Akademi*
2. Electricity and Electronics – D.C. Tayal, *Himalaya Publishing House.*
3. Electronic devices and circuits, Milkman and Halkias. *Mcgraw-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
7. The Prosody Of Pingala. Dr. K. D. Dvivedi & Dr. S. L. Singh, *Vishwavidyalaya Prakashan, Varanasi, 2013.*
8. Development of Combinatorics from Pratyayas in Sanskrit Prosody, Venugopal D. Heroor, *Sanskrit Bharati, Bengaluru,2011.*

Reference Books:

1. Fundamentals of Physics by Halliday, Resnick and 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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Semester VI

Course Name: **Electronics** Practicals– Course Code: **PH 623A P**

HPW: 2 **CREDIT: 1**

Course Objectives: This course is designed to

COB1: *improve skill of measuring V-I characteristics of semiconductor devices.*

COB2*: interpret the working of various Logic gates and Combinational circuits*

1. V-I Characteristics of a Junction diode
2. V-I Characteristics of Zener diode
3. Zener diode as voltage regulator
4. Input/ Output Characteristics of Transistor in CE configuration.
5. RC coupled Amplifier- frequency response
6. RC Phase Shift Oscillator- determination of frequency
7. Construction of a Model DC Power Supply
8. Basic gates construction using discrete components- Verification of truth tables.
9. Construction of universal gates using discrete components- Verification of truth tables.
10. Basic gates construction using universal gates- Verification of truth tables.
11. Half and Full adder circuits
12. Verification of De Morgan's laws.

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

CO1: be able to comprehend theoretical concepts of diode, transistors, FET, UJT and SCR with experimental measurements

CO2: apply knowledge of various Logic gates and Combinational circuits in various applications

Recommended Books:

1. B. Sc Practical Physics, C L Arora, *S. CHAND & Company Ltd.*
2. B. Sc Practical Physics, Harnam Singh Dr P S Hemne, *S. Chand & Company Ltd.*

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B Sc III Year PHYSICS

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

Course Name: **Applied Optics** Course Code: **PH623B** (60 Hours)
(DSE)

HPW: 4 **CREDITS: 4**

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

COB1: *explain the principle of lasers and construction of lasers.*
COB2: *explain the construction and reconstruction of Holograms and applications.*
COB3: *introduce concepts of Fourier optics*
COB4: *establish basic concepts involved in optical fibers*

Unit - I **(15 hrs)**

Principles of Lasers

Introduction, Emission and absorption of Radiation-Einstein coefficients, Pumping mechanisms-optical feedback- Laser rate equations for two, three and four level lasers. Pumping threshold conditions, Properties of laser beams. Types of Lasers: Gas, Liquid and Solid Lasers, He-Ne and Argon lasers with energy level schemes, Ruby laser and YAG laser. Ga-As laser, Applications of lasers.

Unit - II **(15 hrs)**

Holography

Basic Principle of Holography – Recording of amplitude and phase- The recording medium-Reconstruction of original wave front- Image formation by wave front reconstruction, Gabor hologram and its limitations, Off axis Hologram- Fourier transform Holograms- Volume Holograms, Holography applications.

Unit - III **(15 hrs)**

Fourier and Non-Linear Optics

Fourier Optics– Thin lens as phase transformation- Thickness function- Various types of lenses - Fourier Transforming properties of lenses – Object placed in front of the lens- Object placed behind the lens.

Non-linearOptics: Harmonic generation- Second harmonic generation- Phase matching condition-nOptical mixing- Parametric generation of light- self focusing of light.

Unit - IV **(15 hrs)**

Optical fibers

Fiber types and their structures. Ray Optics representation, acceptance angle and numerical aperture. Step And Graded Index fibers, single and multi-mode fibers. Fiber materials for glass fibers and plastic fibers. Signal attenuation in optical fibers: Absorption, scattering and bending losses in fibers, core and cladding losses. Material dispersion, wave guided dispersion, inter modes distortion and pulse broadening.

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Course Outcomes: ***By the completion of this course, students should be able to***

CO1: *interpret the concepts of lasers.*

CO2: *record and reconstruct holographic images.*

CO3: *differentiate between Fourier Optics and Non-linear Optics*

CO4: *understand the concepts of fiber optics*

Recommended Books:

1. Introduction to Fourier Optics by J. Goodman - *Roberts and Company Publishers*
2. Optical fiber Communications by John M senior - *Pearson Education*
3. Principles of Lasers by O Svelto - *Springer Science & Business Media*
4. Introduction to Modern Optics by Grant R. Fowles - *Courier Corporation*
5. Principles of Optics by Born and Wolf - *Cambridge University Press*
6. Fundamentals of Optics by Jenkins & White - *McGraw Hill Education*

Semester VI

Course Name: **Applied Optics Lab** Course Code: **PH623BP**

HPW: 2 **CREDITS: 1**

Course Objectives: *The course is designed to*

COB1: *increase the skill of using lasers for diffraction applications.*

COB2: *develop skill of measurements of Numerical Aperture and losses in optical fibers.*

1. Study of the profile of a laser beam
2. Determination of the diameter of a thin wire using laser
3. Determination of wavelength of He-Ne laser by transmission grating
4. Construction and recording of a hologram.
5. Study of Fourier transforming properties of lenses
6. Study of second harmonic generation by KDP crystal.
7. Measurement of numerical aperture of optical fibers
8. Measurement of coupling losses in optical fibers
9. Measurement of bending losses in optical fibers
10. Study of audio signal transmission through optical fibers
11. To study the interference of light using optical fibers

Course Outcomes: ***By the completion of this course, students should be able to***

CO1: *use laser source for diffraction applications.*

CO2: *comprehend measurements of Numerical aperture and losses in optical fibers.*

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W.e.f the academic year: 2025-26

Semester VI

Course Name: **Nano Science** Course Code: **PH 623_O** (60 Hours)
Optional Paper

HPW: 4 **CREDITS: 4**

Course Objectives: This course is designed to
COB1*: introduce fundamentals of nanostructures.*
COB2: *explain physical and chemical synthesis methods.*
COB3: *introduce characterization techniques for nanomaterials*
COB4: *divulge applications of nanomaterials*

Unit-I **(15 hrs)**
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 hrs)**
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 hrs)**
Characterization: X-ray Diffraction, Optical Microscopy, Scanning Electron Microscopy, Transmission Electron Microscopy, Atomic Force Microscopy Scanning Tunnelling Microscopy.

Unit-IV **(15 hrs)**
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- magnetic data storage. Micro Electrochemical systems (MEMS) Nano Electromechanical systems (NEMS)

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

CO1*: interpret the length scales and hence nano size.*

CO2: *distinguish between different Nano material synthesis methods.*

CO3: *analyze various 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 Nanoscience 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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BOS in Physics
Bhavan's Vivekananda College
Sainikpuri

BHAVAN'S VIVEKANANDA COLLEGE OF SCIENCE, HUMANITIES AND COMMERCE, SAINIKPURI, SECUNDERABAD.

Autonomous College

Affiliated to OSMANIA UNIVERSITY, Hyderabad.

(Accredited with 'A' grade by NAAC)

Syllabus- B Sc III Year PHYSICS

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

Semester VI

Course Name: **Project Work** Course Code: **PH 623_O_PW** (60 Hours)

Optional Paper

HPW: 4 **CREDITS:4**

1. Basic concepts of Project planning

   a) Selection of Project topic and defining objectives
   b) Planning of methods/approaches

2. Guidelines for Project writing

   - Title of the Project, Name of the Student & Supervisor
   - Declaration by the Student & Supervisor
   - Objectives of the project
   - Introduction & Review of Literature
   - Methodology
   - Results and Discussion
   - Conclusion
   - References

Course Objectives:

Cob 1: To select a research topic and execute the work planned using correct methodology.
Cob 2: To organize the completed work in the form of project dissertation and submission.

Guidelines to the students:

1. Project work will involve experimental work/data collection and it has to be completed in the stipulated time by the student.

2. Students will be asked their choice for Project work at the beginning of Semester VI and all formalities of topic and mentor selection will be completed. Project work will be offered as per the expertise and infrastructural facilities available in the department.

3. Project work may be allotted to students as individual or as group project (not exceeding 5 students per group).
4. The completed work and compiled data would be presented in the form of results and submitted in the form of a dissertation/project report.

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5. Final evaluation of the project work will be through a panel consisting of internal and external examiners.

6. Guidelines provided for execution and evaluation of project work would be strictly adhered.

7. The grading would be based on evaluation of punctuality, experimental work, record keeping, academic inputs, data presentation, interpretation etc.

Course Outcome

At the end of the course, students will be able to

CO1: Plan and execute a project effectively in the stipulated time
CO2: Develop analytical, paper writing and oral presentation skills.

PROJECT WORK EVALUATION SCHEME

Presentation of Thesis Dissertation to External Examiner - 70 Marks
Continuous Evaluation by the Internal Examiner - 30 Marks
Total - 100 Marks

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