F.Y.B.Sc. Physics

Course: Mechanics and Properties of Matter

After successfully completing this course, the student will be able to:

CO1: Demonstrate an intermediate knowledge of Newton’s Laws and the equations of motion.

CO2: Analyse the forces on the object and apply them in calculations of the motion of simple systems using the free body diagram.

CO3: Determine whether using conservation of energy or conservation of momentum would be more appropriate for solving a dynamics problem.

CO4: Apply the concepts of elasticity to real world problems.

CO5: List fundamental forces in nature, applications and factors affecting surface tension.

CO6: Define and conceptualize different laws of fluid mechanics and related quantities like steady, turbulent flow and concept of Reynolds number.

CO7: Demonstrate different applications of Bernoulli’s theorem, laws of elasticity, surface tension.

Course: Physics principles & applications.

After successfully completing this course, the student will be able to:

CO1: Define absorption, spontaneous emission and stimulated emission process and describe Laser action describe different atomic models in order to understand atomic structure.

CO2: Classify different types of bonding & their properties.

CO3: Draw electromagnetic spectrum showing different regions and analyze Vibrational & rotational spectra of diatomic molecule.

CO4: Study the properties of Laser and its applications.

CO5: Quote essential principles of operation of radar system and develop the radar for any given frequency.

CO6: Describe principle and construction of solar cell & to calculate efficiency and fill factor of solar cell.

Course: Heat and Thermodynamics

After successfully completing this course, the student will be able to:

CO1: Define laws of thermodynamics, entropy, thermodynamic processes etc.

CO2: Carnot engine, concept of entropy.

CO3: Derive expression for efficiency of heat engine (Otto cycle, Diesel cycle, Carnot cycle), latent heat equation, adiabatic relations for perfect gas, work done during isothermal and adiabatic change.

CO4: Compare reversible and irreversible processes, adiabatic and isothermal process.

CO5: Illustrate that work is a path dependent function using PV diagram and to solve entropy for reversible and irreversible process.

CO6: Apply first law of thermodynamics to solve problems.

CO7: Categorize thermometers and state its applications.

Course: Electricity and Magnetism

After successfully completing this course, the student will be able to:

CO1: Define the basic terms such as electric field, electric potential, magnetic intensity, magnetic induction, magnetic susceptibility and electric and magnetic flux.

CO2: State and conceptualise basic laws in electromagnetic.

CO3: Explain the superposition principle, gauss's law in dielectrics and relation between three electric vectors.

CO4: Solve numerical problems using Coulombs Law ,Gauss's law, Biot-Savart's law,Ampere circuital law and principle of superposition.

CO5: Determine the electric field and potential due to an electric dipole and different types of charge distribution.

CO6: Determine magnetic induction due to various current distributions.

CO7: Derive the relation between three magnetic vectors and compare different types of magnetic material.

CO8: Describe soft and hard magnets on the basis of hysteresis loop.

Course: Physics Practical

[redacted]

CO1: Demonstrate an ability to collect data through observation.

CO2: Acquire technical and manipulative skills in using laboratory equipment, tools and materials.

CO3: Experimentation and interpreting data.

CO4: Demonstrate an understanding of laboratory procedures including safety, and scientific methods.

CO5: Demonstrate a deeper understanding of abstract concepts and theories gained by experiencing and visualizing them as authentic phenomena.

CO6: Acquire the complementary skills of collaborative learning and teamwork in laboratory settings.

S.Y.B.Sc Physics

PH211 Mathematical Methods in Physics I

After successful completion of the course the student will be able to:

CO1: Define the basic operations in complex numbers.

CO2: Explain graphical representation of complex numbers and calculate roots of complex numbers.

CO3: Solve partial differential equations in Physics.

CO4: Discuss vector algebra required in Physics.

CO5: Define and calculate the gradient, divergence and curl of a field.

CO6: Define order, degree and homogeneity of ordinary differential equation.

CO7: Explain singular points of ordinary differential equation.

CO8: Develop problem-solving skills of identifying strategies to solve unfamiliar problem.

PH212 Electronics

After successful completion of the course the student will be able to:

[redacted]

CO2: Calculate power, voltage or current across or through the particular component of a given circuit using circuit theorems; and able to design a circuit for transistor biasing, rectifier.

CO3: Describe construction and working of transistor and its applications in current and voltage amplification using different configurations.

CO4: Describe DC load line and bias point. List, explain, and design and analyze the different biasing circuits.

CO5: Explain real and ideal characteristics of operational amplifier and calculate gain in different modes.

CO6: Describe different applications of operational amplifier.

CO7: Design rectifier circuits, unregulated and regulated power supply.

CO8: Illustrate data from one number system to another and apply Boolean algebra to design logic circuits.

PHY221 Oscillations,Waves and Sound

After successful completion of the course the student will be able to:

CO1: Define periodic and oscillatory motion.

CO2: Setup and solve differential equations of motion for simple harmonic, damped, and forced oscillators.

CO3: Describe oscillatory motion with graphs and equations, and use these descriptions to solve problems of oscillatory motion.

CO4: Discuss phenomenon of resonance and apply in different applications.

CO5: Set and solve differential equation for wave motion for longitudinal and transverse waves.

CO6: Calculate the phase velocity, energy and intensity of simple harmonic waves.

CO7: Discuss the Doppler effect, and predict in qualitative terms the frequency change that will occur for relative motion between source and observer or listener.

CO8: Explain in qualitative terms how frequency, amplitude, and wave shape affect the pitch, intensity, and quality of tones produced by musical instruments.

Course:PHY222 Optics

After successful completion of the course the student will be able to:

CO1: Describe the geometrical formation of images by thin lenses, lens equation and lens makers formula using fundamental laws of geometrical optics.

CO2: Use mathematical analysis to calculate properties of image, formed by combination of lenses and applies theory of optics to calculate the cardinal points of an optical system and design optical devices.

CO3: Describe optical aberrations produced in image by lenses and methods of their removal.

CO4: Describe the construction and operation of optical devices, including, eyepieces, compound microscope, grating, polarisers etc.

CO5: Use mathematical analysis to find bright and dark fringes in an interference pattern of thin and wedge shaped film and find a wavelength of light using newton's rings.

CO6: Interpret a diffraction pattern to determine resolution of an optical system and grating.

CO7: Demonstrate an ability to solve problems using 'paraxial' optics-based formulae, numerical calculations and graphical drawings.

CO8: Geometrical determination of polarization of light and concept and determine a polarization state of light by interpreting polarizer.

PH223: PRACTICAL COURSE

After completing this practical course student will be able to

CO1: Use various instruments and equipment.

CO2: Design experiments to test a hypothesis and/or determine the value of an unknown quantity.

CO3: Describe the methodology of science and the relationship between observation and theory.

CO4: Set up experimental equipment to implement an experimental approach.

CO5: Analyse data, plot appropriate graphs and reach conclusions from your data analysis.

CO6: Work in a group to plan, implement and report on a project/experiment.

CO7: Keep a well-maintained and instructive laboratory logbook.

CO8: Express their knowledge and ideas through oral and written language.

T.Y. B.Sc. Physics

PH-331:Mathematical Methods of Physics

After successful completion of the course the student will be able to:

CO 1: Define and generate a general equation for gradient ,divergence ,curl &laplacian in an orthogonal curvilinear coordinate system & their applications in physics.

CO 2: Interpret relative motion, Galilean & Lorentz transformation equations. CO 3: Define proper time ,minkowskis space ,Time dilation , length contraction CO 4: Describe Michelson Morley experiment & its negative result.

CO 5: Convert commonly occurring partial differential equations in physics into ODE's

CO 6: Illustrate the problems on Frobenius method of series solution and to differentiate point of expansion of given differential equations.

CO 7: Evaluate &plot Legendre polynomials, Hermite polynomials ,Bessel function of first kind.

CO 8: List the most important special functions in physics and to solve different properties related to special functions.

PH-332:Solid State Physics

After successful completion of the course the student will be able to:

CO1: Define crystal structure to develop it in 2D as well as 3D and to determine Indices

for 'Directions' and 'Planes' in a crystal structure.

CO2: Give original examples of crystal structures and to analyze them with packing fraction, coordination number, number of atoms per unit cell etc.

CO3: Derive Bragg Diffraction condition in direct lattice and to relate it in reciprocal lattice using Ewald construction.

CO4: Classify the crystal structure by XRD diffraction and to simplify formula for inter- planer distance.

CO5: Illustrate various experimental techniques for characterisation of material. CO6: Apply free electron theory to restate thermal and electrical properties.

[redacted]

CO8: Define magnetic properties of material and to derive susceptibility formula for different magnetic materials using Lange vein theory.

PH-333:Classical Mechanics:

After successfully completing this course, the student will be able to:

CO1: Solve advanced problems involving the dynamic motion of classical mechanicalsystems with an intermediate knowledge of Newton's laws of motion.

CO2: Apply the concept of Centre of mass and mechanics of system of particles and conservation of energy, linear and angular momentum to solve dynamics problems.

CO3: Demonstrate an intermediate knowledge of central-force motion and the concept of converting two body problems to single body problem and apply advanced methods to complex central-force motion problems.

CO4: Demonstrate an intermediate knowledge of concept of laboratory frame and center of mass frame and their use to calculate results of scattering experiments.

CO5: Apply the concept scattering to get important information regarding the nature of interaction between atomic and subatomic particles through experiments.

CO6: Derive Lagrange and Hamilton's equations, and represent the equations of motion for simple mechanical systems such as: the Atwood's machine, Simple pendulum using these formulations of classical mechanics.

CO7: Acquire working knowledge of the methods of Hamiltonian Dynamics and compute the Hamilton equations of motion for mechanical systems.

CO8: Use calculus of variations to find the Euler-Lagrange equations and canonical transformations to find the constants of motion according to the Hamilton Jacobi theory.

CO9: Use Poisson brackets to find derivatives in phase space.

PH-334:Atomicand Molecular Physics

After successful completion of the course the student will be able to:

CO1: Derive the formulae for total energy of an atom so that energy level diagram can be drawn and also able to obtain the expression for spin orbit interaction energy.

CO2: State laws, postulates in atomic and molecular Physics and able to compare various models of atomic structure.

CO3: Calculate quantum state of electrons in an atom, spectral notation and electronic configuration of atom.

CO4: Obtain formulae for Zeeman shift, wavelength of emitted X-rays, Raman shift, rotational and vibrational energy for diatomic molecule and apply it.

CO5: Explain origin of line spectra and able to compare continuous spectra, characteristic spectra and can differentiate between rotational, vibrational and electronic spectra.

CO6: Explain application of Duane and Hunt's rule, Moseley's law and its

importance, applications of X-rays, Raman effect and Auger effect.

CO7: Draw and explain X-ray spectra, spectrum with and without magnetic field (Zeeman effect),Raman spectra and molecular spectra using quantum treatment.

CO8: Explain experimental arrangement to produce X-ray,, to observe

Raman effect and Zeeman effect.

PH-335:Computational Physics

After successful completion of the course the student will be able to:

CO1: Define types of programming languages and their uses.

CO2: Gain basic competency with a widely used C-language for both general and scientific programming.

CO3: Define operators and expression in C-programming and navigate commands.

CO4: Explain control statements and loops as well as capable of writing C-program to solve problems.

CO5: Describe arrays and pointers and apply them in C program.

CO6: Critically present different numerical methods to solve different types of physical and technical problems.

CO7: Implement numerical algorithms into C-program and visualize the results of the computations.

[redacted]
numerical methods.

PH-336B:Material science

After successful completion of the course the student will be able to:

CO1: Define and outline the rules of solubility, deformation in metals, basic concepts in phase diagram, molecular phases and the concept of smart materials.

CO2: Explain the imperfections in solids, mechanism of plastic deformation by slip, properties of ceramic materials, the importance and objective of phase diagram.

CO3: Calculate and solve problems on stress and strain of materials, CRSS of single phase metals, weight in percentage of compositions using lever rule.

CO4: List the defects in solids, diffusion mechanisms and types of phase diagram.

CO5: Classify between elastic deformation and plastic deformation, linear polymers and cross linked polymers.

CO6: Derive the CRSS of metals and the lever rule for phase diagrams.

CO7: Discuss the types of smart materials, properties of smart materials and their applications.

CO8: Summarize the concept of polymers and the process of polymerization.

PH-341:Electrodynamics.

After successful completion of the course the student will be able to:

CO1: Define the Biot-savart law, Amperes law, Coulombs law, Electric field, Electric susceptibility, Magnetic field &Faradays law.

CO2: Explain method of electrical images, equation of continuity, Magnetic vector potential, B.H curve, Maxwell's equation &wave equations.

CO3: Solve numerical problem on coulombs force, magnetic induction, magnetic permeability and induced voltage, magnitude of electric &magnetic vectors.

[redacted]
wire in different symmetry.

CO5: Summarize pointing vector, polarization, reflection &refraction. CO6: Apply Biot Savart law in different symmetry problem.

CO7: List the applications of Amperes law, Biot Savart law, Poynting theorem. CO8: Elaborate magnetic properties of the material.

PH-342:Quantum Mechanics

After successful completion of the course the student will be able to:

CO1: Outline the historical aspects of development of quantum mechanics. CO2: Explain the differences between classical and quantum mechanics. CO3: Describe matter waves, wave function and uncertainty principle.

CO4: Describe Schrodinger's equation and its steady state form.

CO5: Solve Schrodinger's steady state equation for simple potentials to obtain eigen functions and eigen values.

CO6: Apply Schrodinger's steady state equation for spherically symmetric potentials

Obtain eigen functions and eigen values.

CO7: Interpret quantum numbers in atomic system. CO8: Discuss operator algebra in quantum mechanics.

PH-343:Thermodynamics and Statistical Physics

After successful completion of the course the student will be able to:

CO1: Describe transport phenomena and compute coefficient of thermal conductivity, viscosity and diffusion in terms of mean free path.

CO2: Define and discuss the concepts and roles of thermodynamic functions from the view point of statistical mechanics.

CO3: Derive Binomial distribution and Gaussian probability distribution using random walk problem and calculate mean values for a statistical system.

CO4: Discuss the concepts of microstate and macro state, basic postulates and behaviour of density of states for model system and calculate the number of microstates for different statistical systems.

CO5: Differentiate thermal, mechanical and general interaction between statistical system

CO6: Derive and compare Maxwell Boltzmann, Bose-Einstein and Fermi-Dirac distributions; state where they are applicable and explain the connection between

Classical and Quantum Statistics.

CO7: Derive probability distribution formula for micro canonical, canonical ensemble and calculate mean values in canonical ensemble.

CO8: Discuss applications for canonical ensemble.

PH-344:NuclearPhysics

After successful completion of the course the student will be able to:

- CO1: Define threshold voltage, dead time and recovery time in GM counter, threshold energy, nuclear fission, nuclear fusion, critical size, critical mass.
- CO2: Determine the basic properties of nucleus.
- CO3: Classify nuclear radiations, elementary particles and nuclear states, nuclear detectors.
- CO4: Compose baryons and mesons with Quark model.
- CO5: Derive expression for energy of ions and frequency of RF signal in cyclotron, Q- value equation, threshold energy, decay constant.
- CO6: Estimate binding energy from fission.
- CO7: Justify nuclear reactions using conservation laws.
- CO8: Explain the different processes by which energetic particles interact with matter, kinematics of various reactors and decay processes.

PH-345ElectronicsII

After successful completion of the course the student will be able to:

- CO1: Define and state the meaning of terms such as amplification, voltage gain, line and load regulation, flip-flop, counters, register, distortion, multiplexer, de-multiplexer, etc.
- CO2: Draw and explain characteristics of various types of FET's and various types ofdiode and construct a circuit using these components according to application.
- CO3: Draw and explain block diagram of IC 723, IC555, OPAMP.
- CO4: Compare various types of semiconductor diode (LED, photodiode, etc.) types of multivibrator, types of power amplifier and types of three pin regulators (78XX,79XX, etc.) on the basis of working principle and application.
- CO5: Design and construct a circuit for amplifier, a-stable, mono-stable and bi stable multivibrator using IC555, low voltage and high voltage regulator using IC723, various types of flip-flop and counters.
- CO6: Use OPAMP (IC723) as an adder, subs tractor, differentiator, integrator and comparator.

[redacted] adder, full adder, half subs tractor, full subs tractor using K-map.

CO8: Explain applications of LED, photodiode, veractor, power amplifiers, FET, UJT, counters, registers and solve the problems such as write the output for given circuit, design the circuit from given data.

PH-346K:Laser

After successful completion of the course the student will be able to:

CO1: Explain the interaction of radiation with matter, Quantum behaviour of light, thermal equilibrium and population inversion.

CO2: Illustrate the absorption, spontaneous and stimulated emission with appropriate diagrams.

CO3: Derive the Einstein's relation, conditions for large stimulated emission and light amplification.

CO4: Distinguish between ordinary light and laser light. CO5: Define the characteristics of laser light.

CO6: Classify between lifetime broadening, collision and Doppler broadening. CO7: List the types of lasers.

CO8: Discuss the applications of lasers in various fields.

Physics Practical-I

After successful completion of the course the student will be able to:

CO1: Describe the underlying theory of experiments in the course.

CO2: Perform derivations of theoretical models of relevance for the experiments in the course.

CO3: Follow instructions to perform laboratory experiments in Optics, Thermodynamics, Mechanics, Modern Physics, Electronics and Electromagnetics.

CO4: Document their results, using correct procedures and protocols.

CO5: Perform a quantitative analysis of experimental data including the use of computational and statistical methods where relevant.

CO6: Interpret relationships in graphed data and develop an intuition for alternative plotting methods and communicate results from laboratory experiments, orally or in a written laboratory report.

[redacted]

CO8: Derive conclusions from the analysis of own data.

CO9: Assess the language used to describe physics experiments and how it can alter perceptions of the method and results

Physics Practical-II

After successful completion of the course the student will be able to:

CO1: Describe the underlying theory of experiments in the course.

CO2: Perform derivations of theoretical models of relevance for the experiments in the course.

CO3: Follow instructions to perform laboratory experiments in Optics, Thermodynamics, Mechanics, Modern Physics, Electronics and Electromagnetics.

CO4: Document their results, using correct procedures and protocols.

CO5: Perform a quantitative analysis of experimental data including the use of computational and statistical methods where relevant.

CO6: Interpret relationships in graphed data and develop an intuition for alternative plotting methods and communicate results from laboratory experiments, orally or in a written laboratory report.

CO7: Calculate permissible standard error in any physics experiment

CO8: Derive conclusions from the analysis of own data.

CO9: Assess the language used to describe physics experiments and how it can alter perceptions of the method and results

Physics Practical-III: Project

After successful completion of the course the student will be able to

CO1: Design and test hypothesis.

CO2: Describe the underlying theory of experiments in the course.

CO3: Perform derivations of theoretical models of relevance for the experiments in the course.

CO4: Document their results, using correct procedures and protocols.

[redacted]
including the use of computational and statistical methods where relevant.

CO6: Interpret relationships in graphed data and develop an intuition for alternative plotting methods and communicate results from laboratory experiments, orally or in a written laboratory report.

CO7: Write a project report with literature review.

CO8: Defend the outcome of project work in scientific manner.

M. Sc. Physics Part I

PHYUT501: Classical Mechanics

After successfully completing this course, the student will be able to:

CO1: Formulate the Lagrange's and Hamilton's equation of motion for different systems. CO2: Choose an appropriate set of generalised coordinates to describe the system.

CO3: Classify and handle the problem related to motion in non-inertial and inertial frames. CO4: Solve problems on poisons brackets and canonical transformations.

CO5: Apply Variational Principle to real physical problem.

CO6: Explain the concept of symmetry and Galilean Invariance. CO7: Define generalized momenta and cyclic coordinates.

CO8: Recall Poisson's and Lagrange identities.

PHYUT502:Electronics

After successfully completing this course, the student will be able to:

CO1: Recall basic knowledge of electronics.

CO2: Define Astable, monostablemultivibrator, Op-amp, voltage regulators, Boolean identities and expression, counter and shift register, basics of digital and binary conversions.

CO3: Discuss IC 555, types of voltage regulators, types of counters and shift registers and types of ADC and DAC.

CO4: Perform working of ICs (IC 555 in astable and monostable mode, IC78xx/IC79xx and ICLM317 of 3 pin regulators, IC 7490,IC 7495, VCO IC 566, PLL IC 565)

[redacted]
applications. CO6: Designs and performs ICs.

CO7: Assemble the ICs

CO8: Communicate, demonstrate and write effectively the needs in industrial fields.

PHYUT503:Mathematical Methods in Physics

After successfully completing this course, the student will be able to:

CO1: Generate Legendre, Hermite, Laguerre polynomials and Bessel functions of first kind.

CO2: Determine Laplace transform of standard functions.

CO3: Classify methods to obtain Laplace transform and inverse Laplace transform. CO4: Illustrate the examples of vector spaces.

CO5: Solve problems on Fourier series, Fourier transform and Fourier integral.

CO6: Solve problems on linear dependence and linear independence by using different methods.

CO7: Explain orthogonality of Legendre, Hermite, Laguerre polynomials and Bessel functions of first kind.

CO8: Define Hermitian, Orthogonal and Unitary matrices.

PHYUT504:Atomic and MolecularPphysics

After successfully completing this course, the student will be able to:

CO1: Recite atomic structure, quantum number Calculate the ground state, apply Hund's

rule. Diagram the fine and hyperfine structure

CO2: Explain Zeeman effect Solve problems on Zeeman effect for different materials in

Zeeman effect

CO3: Identify different regions of spectra & Summarize types of spectra with regions

CO4: Classify different molecular spectra &analyse band structure

CO5: Determine dissociation energy and dissociation product for explanation of ESR & NMR

CO6: Predict the band head position in rotational fine structure to solve problems on ESR

&NMR.

CO7: Define X-ray diffraction, Explain SC, FCC, BCC HCP structure and calculate atomic structure factor of SC, FCC, BCC, HCP and diamond structure.

CO8: Explain different modes of vibration. Simplify atomic scattering factor. Relate

Acoustic & optical modes of vibration

PHYUT505:Experimental techniques in Physics-I

After successfully completing this course, the student will be able to:

CO1: Define signals, vacuum, vacuum measurement units, gas transport phenomenon. CO2: Classify signals and systems as discrete/continuous, linear/non-linear, causal/noncausal, time-variant/invariant, etc., errors in signals and pipe flows, vacuum pumps. CO3: Interpret signals with correlation function of random processes.

CO4: Explain need of vacuum and gas transport properties.

CO5: Solve problems based on kinetic theory of gases and the application of the momentum and energy equations as well as various parameters of fluid mechanics

C06: Convert vacuum measurement units from one unit to another unit.

CO7: Describe different vacuum gauges and vacuum pumps with their working principle, range of measurement, advantages and drawbacks.

CO8: Apply vacuum principles in preparation of thin and thick film.

PHYUT506:Physics Lab-I

After successfully completing this course, the student will be able to:

CO1: Explain and analyse Frank-Hertz experiment and the obtained data

CO2: Compare the observed value of the skin depth experiment with the theoretical t value and determine the sources of error.

CO3: Summarise the theory of GM tube and list characteristics of radio activity. CO4: Determine the Lande's g factor by using Electron spin resonance experiment. CO5: Illustrate the electromagnetic damping using ballistic galvanometer.

CO6: Show the iodine spectrum and analyse it.

CO7: Show steady interference pattern using etalon and determine the spacing between two plates of etalon.

CO8: Explain the basics of determination of resistivity of a thin film by using four probe method.

PHYUT601:Electrodynamics

After studying this course the student will be able to,

CO1: Define electric charge, charge density (λ , σ, ρ).

CO2: Apply the laws of electromagnetism and Maxwell's equations in different forms

and different media

CO3: Explain the fundamental concepts of special relativity and their physical consequences, such as the Lorentz transformation, invariant quantities, the metric, and four-vectors and more general tensors, as well as their use in covariant formulations of physical laws.

CO4: Discuss origin of Maxwell's equations in magnetic and dielectric media and understand transport of energy and Poynting vector.

CO5: Calculate the magnetic forces that act on moving charges and the magnetic fields, due to currents (Biot-Savart and Ampere laws)

CO6: Solve multipole expansions of electrostatic fields.

CO7: Analyze propagation, reflection and transmission of plane waves

CO8: Evaluate radiation energy losses by passage through the matter.

PHYUT602:Solid State Physics

After successfully completing this course, the student will be able to:

CO1: Calculate thermal and electrical properties in the free-electron model - know

Bloch's theorem and what energy bands are

CO2: Apply the free electron theory to solids to describe electronic behaviour& explain the origin of energy bands, and how they influence electronic behaviour.

CO3: discuss basic models of magnetism &Explain the classical, Langevin& quantum theory of Para magnetism.

CO4: Compare the magnetic properties of rare earth ions & iron group ion with graphical representation

CO5: Explain Wises theory, saturation magnetism with temperature dependence. CO6: Understand the anti-ferromagnetism, Neel temperature & susceptibility.

CO7: Distinguish between perfect conduction and perfect diamagnetism, and give a qualitative description of the Meissner effect & explain how observation of a persistent current can be used to estimate an upper limit on the resistivity of a superconductor, and perform calculations related to such estimates

CO8: Show how the London equations and Maxwell's equations lead to the prediction of the Meissner effect.

PHYUT603:Quantum Mechanics

After successfully completing this course, the student will be able to:

CO1: Recall the main aspects of the historical development of quantum mechanics by replacing the classical mechanics and able to discuss wave properties of matter.

CO2: Understand Schrodinger's equation, uncertainty principle, representation of states,

relation between quantum mechanics and linear algebra.

CO3: Solve Schrodinger's equation in one to three dimensions, Eigen function of operator, uncertainties as well as their physical interpretations.

CO4: Solve problems by applying Dirac notations.

CO5: Simplify angular momentum and spin, their rules for quantization and additions, Clebsch-Gorden coefficients in simple cases.

CO6: Explain Zeeman Effect, spin- orbit coupling.

CO7: Solve Schrodinger equation using various approximation methods.

CO8: Develop an understanding of both analytic and numerical methods and solution are important in quantum mechanics.

PHYUT604:LASERS

After successfully completing this course, the student will be able to:

CO1: Explain the interaction of radiation with matter, Gaussian beam and their properties.

CO2: Illustrate the absorption, spontaneous and stimulated emission with appropriate diagrams.

CO3: Derive the Einstein's coefficients, g-parameters of laser cavity. CO4: Distinguish between ordinary light and laser light.

CO5: Analyse the merits and demerits of three and four level laser system. CO6: List the characteristics of laser light.

CO7: Categorise the different types of lasers.

CO8: Discuss the applications of lasers in various fields

PHYUT605:Experimental Techniques in Physics-II

After studying this course the student will be able to,

CO1: List of required characterization techniques for fundamental research in material science and nanotechnology.

CO2: Identify the crystal structure, crystalline nature of any material by using X-ray diffraction technique.

CO3: Provide phase transition, absorption, chemical changes as temperature changes by using thermal analysis methods.

CO4: Make use of spectroscopic analysis for identification of materials i.e. which type of material is present by analysing their UV-Vis, IR, FTIR, DRS spectroscopies.

CO5: Study morphology, topography of any material by using SEM, TEM, and FESEM. CO6: Find various applications like industrial, biomedical etc. by using magnetic

characterization.

CO7: Apply the knowledge of characterization techniques for research.

CO8: Compile the information of characterization together to confirm the proposal in research work.

PHYUT606:Physics Lab-II

After successfully completing this course, the student will be able to:

CO1: Make use of analog and digital multi meters, various types of power supply, CRO, Function generator.

CO2: Classify between AC and DC voltage and current. CO3: Identify passive and active electronic components.

CO4: Design various types of electronic circuits professionally and mounting of

electronic components on bread board and PC – cum – soldering method. CO5: Explain the Kirchhoff's voltage and current law and verify it.

CO6: Distinguish between the active filters.

CO7: Experiment with CRO to find the amplitude, peak. time interval. CO8: Defend the results obtained in the experimental work.

M.Sc. Physics Part II

PHYUT701:Statistical Mechanics

After successfully completing this course, the student will be able to:

CO1: Define basics of thermodynamics, states of the system, statistical ensemble, partition function, and equipartition theorem, postulates of Maxwell-Boltzmann, Bose- Einstein and Fermi-Dirac distributions and discuss black body radiation.

CO2: Describe specification of state of system, types of ensembles, Gibb's paradox.

CO3: Calculate phase space trajectory, mean energy of the system, simple application of equipartition theorem and solve Einstein derivation of Plank's law, Bose condensation, and specific heat of fermions.

CO4: Criticize state of system classically, categorized between types of ensembles, classify distribution of particles by

Maxwell-Boltzmann, Bose-Einstein and Fermi Dirac statistic, analyse Einstein and Debye model of solids.

CO5: Determine density of states, mean energy by using types of ensembles, Fermi energy and mean energy at absolute zero, compare mean values of velocities by using Maxwell Boltzmann distribution.

CO6: Develop some problems dealing with statistical ensemble and Fermi energy, to solve some examples on particles by using particle distribution statistics.

CO7: Demonstrate understanding of various aspects of statistical mechanics.

CO8: Communicate, write, and make effective presentation on industrial needs of thermodynamics and statistical mechanics.

PHYDT702: Physics of Thin Films

After successfully completing this course, the student will be able to:

CO1: Recognize the various aspects of different thin film deposition, fundamental properties and various measurement techniques

CO2: Relate effect of various deposition parameters to growth of thin films and their typical uses for applications.

CO3: Discuss the differences and similarities between techniques and fundamental properties of thin film deposition.

CO4: Asses the relation between deposition technique, film structure and film properties.

CO5: Analyse effect of film growth on properties.

CO6: Evaluate and use models for nucleating and growth of thin films.

CO7: Motivate selection of deposition techniques for various applications.

CO8: Design novel thin film material synthesis by modified growth technique.

PHYUT703:Physics of Semiconductor Devices

After successfully completing this course, the student will be able to:

CO1: Recognize the physical characteristics such as electronic structures, optical and transport properties of semiconductors and IV characteristics of semiconductor devices.

CO2: Discuss the transport and optical properties of semiconductors.

CO3: Relate the electronic structures of semiconductors to their atomic and crystal characteristics.

CO4: Relate to fundamental physics process with device characteristics.

CO5: Apply fundamental principles and processes to operational semiconductor devices and their uses.

CO6: Analyse and model some semiconductor properties, processes and device characteristics using equations.

CO7: Evaluate and analyse device characteristics in terms of the material properties and structural parameters.

CO8: Design junction device and calculate its various junction parameters.

PHYDT704:Electronic Instrumentation-I

After successfully completing this course, the student will be able to:

CO1: Explain functional description of instrumentations and methods of correction of unwanted inputs.

CO2: Demonstrate the errors in measurements. Explain the sources of errors. Calculate the first order instrumentation step, ramp and frequency response.

CO3: Define the transducer and types of transducer.

CO4: Classify different types of transducer and select transducer for application.

CO5: Remember basic op-amp and its applications and explain instrumentation amplifier.

CO6: Compare different types of data converters.

CO7: Explain working of LED AND LCD display system and give original applications of display system. Explain working of printer.

CO8: Explain microprocessor based instruments and basic idea of process control.

PHYUP705:Computational Physics

After successfully completing this course, the student will be able to:

CO1: Recall the theory of all the programmes to be performed.

CO2: Draw the algorithm and flowchart chart of the concepts discussed.

CO3: Design the flow chart using the theory and the derivation of the concepts.

CO4: Estimate the required value by running the programme on turbo C.

CO5: Interpret the value obtained on turbo C and manually.

CO6: Illustrate the motion of pendulum, oscillations and miller indices on turbo C

CO7: Determine kinetic, potential energy, binding energy etc. by designing programs.

CO8: Diagram the results of program using graphics in C

PHYDP706:Special Lab-I

After successfully completing this course, the student will be able to:

CO1: Develop skills in using laboratory apparatus and equipment.

CO2: analyse and interpret the theoretical and experimental data.

CO3: Classify between the binary ladders.

CO4: Discuss the theories of the performed experiments.

CO5: Recall the binary coding and will be able to design the analog and digital counters

CO6: Explain the working principle of spin coating, spray pyrolysis and electro-deposition.

CO7: Illustrate the characteristics of temperature vs resistance in determining the temperature coefficient of resistance.

CO8: Apply the concepts learned in various fields.

PHYUT801:NuclearPhysics

After studying this course the student will be able to,

CO1: Classify elementary particles and nuclear states in terms of their quantum numbers.

CO2: Describe the role of S-O coupling in the shell structure of atomic nuclei and predict the properties of nuclear ground and excited states based on the shell model.

CO3: Describe the properties of strong and weak interactions.

CO4: Explain the different processes by which ionising radiation interacts with matter and the construction and applications of detectors for radioactivity.

CO5: Determine the basic properties of nucleus.

CO6: Calculate the kinematics of various reactions and decay processes.

CO7: Analyse production and decay reactions for fundamental particles by applying conservation principles.

CO8: Evaluating: Evaluate radiation energy losses by passage through the matter.

PHYUT802: Material Science

After studying this course the student will be able to,

CO1: Define laws of thermodynamics, thermodynamic functions, solubility deformation in metals, phase diagram, molecular phases, diffusion, and solid solution.

CO2: Discuss Defects in the material and classify them.

CO3: Explain the imperfections in solids, the concept of phase & phase diagram, Construction and identification of phase diagrams and reactions, mechanism of plastic deformation by slip, properties of ceramic materials,

CO4: Solve problems on Phase rule, weight in percentage of compositions using lever rule, diffusion, CRSS of single phase metals, thermodynamic problems.

CO5: Analyse phase diagrams.

CO6: Classify defects in solids, solid solutions, phase diagrams.

CO7: Derive chemical equilibrium, thermodynamic properties of solutions, Henry's law, Vegard's law, diffusion coefficient.

CO8: Apply Gibb's phase rule for unary and binary phase diagram, diffusion phenomenon to explain decarburization of steel.

PHYDT803:Nanomaterials

After studying this course the student will be able to,

CO1: Define quantum size effect.

CO2: Explain Surface & Interface effects, Surface energy & Surface curvature.

CO3: Explain the quantum confinement effect on properties of various types of inorganic nanoparticles, one-dimensional nanostructures (nanotubes, nanorods, nanowires).

CO4: Give a basic introduction to chemical and physical principles in the synthesis of inorganic nanostructured materials.

CO5: Cover appropriate synthesis techniques and characterization of different quantum nanostructures of desired size, shape and surface properties.

CO6: Qualitatively describe how the nanoparticle size can affect the morphology, crystal structure, reactivity, and electrical properties.

CO7: Provide the influence of dimensionality of the nanomaterials on properties and their future applications in various technologically important devices.

CO8: Defend different applications of nano materials.

PHYDT804:Electronic Instrumentation-II

At the completion of this course, students will be able to:

CO1: Understand the basic principles & importance of process control in industrial process plants; Specify the required instrumentation and final elements to ensure that well-tuned control is achieved; Understand the use of block diagrams & the mathematical basis for the design of control systems;

CO2: Understand working of PLC, I/O modules of PLC, Programming languages and instructions of PLC

CO3: Explain Process Characteristics.

CO4: Apply different controller modes.

CO5: Handle different types of controller like electronic controller.

CO6: Understand the concept of digital control system.

CO7: Ability to create a model prediction based upon new input and validate the output data.

CO8: Familiarize the student in introducing and exploring MATLAB software &To enable the student on how to approach for solving problems

PHYDP805:Special Lab-II

After successfully completing this course, the student will be able to:

CO1: Recall the theory of nanomaterials

CO2: Discuss different methods of preparation of nanomaterials.

CO3: Apply different methods to prepare nano particles and analyze them.

CO4: Calculate particle size and determine crystal structure using X-ray results. CO5: Design electronic circuits using Operational amplifiers.

CO6: Discuss different transducers.

CO7: Interpret the results of data through experimentation and graph

CO8: Defend the results obtained in the experimentation.

PHYUP806:Project

After successful completion of the course the student will be able to

CO1: Design hypothesis for their work to be carried out.

CO2: Describe the underlying theory of experiments in the project work.

CO3: Perform derivations of theoretical models of relevance for the experiments in the project.

CO5: Perform a quantitative analysis of experimental data including the use of computational and statistical methods where relevant.

CO4: Document their results, using correct procedures and protocols.

CO6: Interpret relationships in graphed data and develop an intuition for alternative plotting methods and communicate results from project work, orally or in a written laboratory report.

CO7: Write a project report with literature review.

CO8: Defend the outcome of project work in scientific manner.