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T.Y.BSc Physics P –II (CBCS Pattern 2019)

Semister –VI (PHY-362): Quantum Mechanics

Sr.No	Month	Total Lectures	Name of the Topic
1	Dec 2023	08	**CH-I: Origin of Quantum Mechanics** Historical Background: Black body radiation, photoelectric effects.Matter waves - De Broglie hypothesis. Davisson and Germer experiment.Wave particle duality Concept of wave function, wave packet, phase velocity, group velocity and relation between them Heisenberg's uncertainty principle with Electron diffraction experiment, different forms of uncertainty.Different fields of applications of quantum mechanics Problems
2	Jan 2024	10	**CH-II: The Schrodinger equation** Physical interpretation of wave function ,Schrodinger time dependent equation.Schrodinger time independent equation.(Steady state equation).Requirements of wave function.Probability current density, equation of continuity, and its physical significance.An operator in Quantum mechanics, Eigen function and Eigen values.Expectation value, Ehrenfest's theorem (Only statements) Problems
3	Feb 2024	14	CH-III: **Applications of Schrodinger Steady state equation** 1. Free particle. 2. Step potential. 3. Potential barrier. (Qualitative discussion). Barrier penetration and tunnelling effect. 4. Particle in infinitely deep potential well (one - dimension). 5. Schrodinger's equation in spherical polar co-ordinate system. 6. Rigid rotator (free axis). 7. Problems
4	March 2024	04	CH-IV: **Operators in Quantum Mechanics:** 1.Hermitian operator. 2. Position, Momentum operator, angular momentum operator, and total energy operator (Hamiltonian). 3. Commutator brackets- Simultaneous Eigen functions. 4. Commutator Algebra 5. Commutator bracket using position, momentum and angular momentum operator 6. Concept of parity according to quantum mechanics, parity operator and its Eigen values. 7. Problems

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T.Y.BSc Physics P –IV (CBCS Pattern 2019)

Semister –VI (PHY-364): Nuclear Physics

Sr.No	Month	Total Lectures	Name of the Topic
1	Dec 2023	12	**CH-I: Nuclear Structure, Properties and Radioactivity** a)Basic Concept of Nucleus:Composition, charge, size, density of nucleus(Revision) Nuclear Angular momentum, Nuclear magnetic dipole moment Electric quadrupole moment, Parity & symmetry,Mass defect and Binding energy, packing fraction,Classification of nuclei,Stability of nuclei (N Vs Z Curve) Day to day applications of Nuclear PhysicsProblems. b)Radioactivity:Radioactivity disintegration (concept of natural and artificial radioactivity, Properties of α, β, γ-rays, Laws of radioactive decay, half-life, mean life, Specific activity and its units (Revision) Successive disintegration and equilibriums and radioisotopes.Radiocarbon dating Application of radioactivity (Agricultural, Medical, Industrial, Archaeological).Problems
2	Jan 2024	06	**CH-II: Particle Accelerator and Radiation Detectors** Particle Accelerators:Introduction and Classification Linear Accelerator (electron/proton LINAC) Cyclic Accelerator (Cyclotron) Particle Accelerators In India (Discussion only) Nuclear Detector: Classification of Nuclear Detectors Gas filled Detectors (G. M. counter) Solid state detectors (scintillation counter) Problems
3	Feb 2024	09	**CH-III: Nuclear forces and Nuclear Models** a)Nuclear Forces: Classification of Nuclear Forces Meson theory of nuclear forces, Properties Of nuclear forces, properties of deuteron system, Elementary particles b)Nuclear Models:Quarks model for elementary particles Shell Model: Assumptions, Evidences, and Spin and Parity limitations. Liquid drop model: Assumptions Semi-empirical B.E. formula, Problems
4	March 2024	09	**CH-IV: Nuclear Reactions and Reactor Theory** a)Introduction to Nuclear reactions: Nuclear Reaction, Conservation laws (Revision) The Q-value equation, Exothermic and Endothermic reaction ,Compound nucleus,Threshold energy,Nuclear cross-section ,Nuclear fission , nuclear fusion stellar energy, chain reaction and critical mass b)Reactor Theory: Nuclear reactor and its basic components, homogeneous and heterogeneous reactors, power reactor, fast breeders ,Nuclear Reactors In India (Discussion only)

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T.Y.BSc Physics P –X (CBCS Pattern 2019)

Semister –VI (PHY-1610 SEC(X)): Calibration Techniques

Sr.No	Month	Total Lectures	Name of the Topic
1	Dec 2023	04	**CH-I: Principles of Calibration** Introduction and Importance of Calibration Traceability in Calibration, Calibration Uncertainty Various Calibration Methods ,Factors Affect Calibration Instrument Classification and Instrument Identification
2	Jan 2024	04	**CH-II: Pressure Calibration** Introduction to pressure calibration ,Pressure unit conversion standards ,Types of Pressure Gauges Calibration of Pressure Gauges:Accuracy ,Pressure Media Contamination ,Height Difference ,Leak test of Piping Adiabatic Effect ,Torque Force ,Calibration Position Generating Pressure ,Pressurizing the Gauge Reading the Pressure Value ,Number of Calibration Points Hysteresis,Number of Calibration cycles Instruments required for calibration: Pressure comparator ,Master Gauge Pressure Calibration with Example
3	Feb 2024	04	**CH-III: Calibration of Electronic Instruments** Identification of Components ,Equipment required for calibration ,Procedure of Calibration ,Read operational Specifications ,Sequence of events ,Identification of common Faults Electronic Calibration with Examples (Oscilloscopes, Multimeters, Function Generators, Signal Generators)
4	March 2024	04	**CH-IV: Temperature Calibration** Temperature units and Conversions ,Temperature Sensors Calibration of temperature sensors: Handling temperature sensor ,Preparations ,Temperature sources ,Reference Temperature Sensor ,Immersion Depth Stabilization ,Temperature sensor handle ,Calibrated temperature range ,Calibration Points ,Adjusting/trimming a temperature sensor Examples

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T.Y.BSc Physics P –II (CBCS Pattern 2019)

Semister –V (PHY-352): Electrodynamics

Sr.No	Month	Total Lectures	Name of the Topic
1	July 2023	12	**CH-I: Electrostatics** Revision of Coulomb's law, Gauss law, Electric field, Electrostatic Potential.Potential energy of system of charges.Statement of Poisson's and Laplace's equation, Boundary Value problems in electrostatics,Solution of Laplace equation in Cartesian system, Boundary conditions. Polarization **P**, Electric displacement **D**, Electric susceptibility and dielectric constant, bound volume and surface charge densities.Electric field at an exterior and interior point of diclectric.
2	August 2023	12	**CH-II: Magnetostatics** Concepts of magnetic induction, magnetic flux and magnetic field.Magnetic induction due to straight current carrying conductor, magnetization of matter, relationship between **B, H** and **M.** Boundary conditions at the interface of two magnetic media (Normal and tangential components).Biot-Savart's law, Ampere's force law, Magnetic force between two current carrying loops, Ampere's circuital law.Equation of continuity, Magnetic vector potential **A,** Magnetic susceptibility and permeability.
3	Sep. 2023	12	**CH-III: Electrodynamics** Day to day applications of Electrodynamics.Concept of electromagnetic induction, Faradays law of induction, Lenz's law, displacement current, generalization of Amperes' law. Maxwell's equations (Differential and Integral form) and their physical significance.Polarization, reflection and refraction of electromagnetic waves through media. Wave equation and plane waves in free space. Poynting theorem and Poynting vector.

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T.Y.BSc Physics P –III (CBCS Pattern 2019)

Semister –V (PHY-353): Classical Mechanics

Sr.No	Month	Total Lectures	Name of the Topic
1	July 2023	08	**CH-I: Motion of Particles** Charged Particles:Motion of a charged particle in constantelectric,magnetic and electromagnetic field,System of particles:Concept of Centre of mass,Conservation of linear momentum, angular momentum, energy of system of particles.(statements only)Day to day applications of Classical mechanics,Problems
2	August 2023	08	**CH-II : Central force Field** Central force Field: Definition and Properties of central force field. Reduction oftwo body problem to an equivalent one body problem Motion in central force field,Kepler's laws of planetary motion and their proof Artificial satellite and its orbit Problems.
3	Sep. 2023	10	**CH-III: Scattering of particles** Elastic and inelastic scattering: Definition and properties, Elastic scattering - Laboratory and center of mass system. Scattering: Scattering angles in laboratory and center of mass system.Differential cross-section, impact Parameter, total cross-section in briefProblems
4	October 2023	10	**CH-IV: Langrangian and Hamiltonian formulation** Limitations of Newton's Law of Motion,Constraints and Their Classification, Example of Constrains, degrees of freedom, generalized coordinate,configuration space,Principle of Virtual work done,D'Almeberts Principle of virtual work,Langrangian equation from D' Alembert's principle, cyclic coordinates,Phase space, Hamiltonian's equations Problems **REVISION**

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T.Y.BSc Physics P –XI(CBCS Pattern 2019)

Semister –V (PHY-3511(M)):Non-destructive testing Techniques

Sr.No	Month	Total Lectures	Name of the Topic
1	July 2023	06	**CH-I : Introduction to Non-destructive Techniques** Definition and objectives of NDT, introduction to materials testing, purpose of testing and properties of materials, classification of material testing, destructive testing and its examples only, Definition, Characteristics detected, principle, advantages, limitation and applications of various methods like Visual inspection, liquid penetrant testing, magnetic particle testing, thermography testing, eddy current testing, ultrasonic testing, acoustic emission testing, radiography testing,
2	August 2023	06	**CH-II: Various Non-Destructive testing Methods-1** What are the discontinuities, Types of discontinuities in materials? Processing the discontinuity, service induced discontinuity, factors for selection of NDT method in different cases of discontinuity, brief description of equipment used in visual testing method, Principles of liquid penetrant method, stages of liquid penetrant process, liquid penetrant process flow chart, chemical and solvent cleaning methods of surface preparation, how to apply and removal of excess penetrant?, application of developer, and observation of defects, penetrant, their types and properties, role of developer, their types, Magnetic particle testing method, procedure of Magnetic particle testing methods, portable magnetization equipment and stationary magnetization equipment, dry and wet particle inspection techniques and stages involved in it and its applications
3	Sep. 2023	06	**CH-III: Various Non-Destructive testing Methods-2** Thermography testing, basics of infrared theory, range characteristics,wavelength,frequency,emission,convection, conduction, reflection, transmission, emissivity of infrared, basic principles of thermography testing, elements of infrared detection system, thermography testing active and passive approach, basics of eddy current testing, working principles of eddy current testing, stages in eddy current testing, factors influencing in eddy current testing, Ultrasonic testing and its methods ,Acoustic emission testing, factors influencing acoustic wavepropagation and data acquisition, instrumentation of acousticemission testing, Radiography testing, principle, various stages in testing, gamma ray radiography testing, SWSI and DWSI techniques in X ray testing, Fluoroscopy testing arrangement and working principle, Computed tomography in NDT

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