গড়গাঁও মহাবিদ্যালয়

GARGAON COLLEGE

NAAC accredited with 'B' Grade

TEACHING PLAN
DEPARTMENT OF PHYSICS
JULY 2022 - JUNE 2023

গড়গাঁও মহাবিদ্যালয়
GARGAON COLLEGE
NAAC accredited with 'B' Grade

NAME OF THE TEACHER: MR. DIGANTA KONWAR
DESIGNATION: ASSISTANT PROFESSOR
SESSION: JULY - DECEMBER 2022

TEACHING PLAN
2022-23

MR. DIGANTA KONWAR
Associate Professor
Department: Physics
Gargaon College
Simaluguri-785686

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TEACHING PLAN FOR ODD SEMESTER

Paper Code/Title	Paper Title: MECHANICS Paper Code: C-2
Allotted Unit/Topic	Fluid Motion, Gravitation and Central Force Motion, Oscillations, Non-inertial Systems.
Number of Classes	23
Details of the topic	Fluid Motion: Kinematics of Moving Fluids: Poiseuille's Equation for Flow of a Liquid through a Capillary Tube **Gravitation and Central Force Motion:** Law of gravitation. Gravitational potential energy. Inertial and gravitational mass. Potential and field due to spherical shell and solid sphere. Motion of a particle under a central force field. Two-body problem and its reduction to one-body problem and its solution. The energy equation and energy diagram. Kepler's Laws. Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS). **Oscillations:** SHM: Simple Harmonic Oscillations. Differential equation of SHM and its solution. Kinetic energy, potential energy, total energy and their time-average values. Damped oscillation. Forced oscillations: Transient and steady states; Resonance, sharpness of resonance; power dissipation and Quality Factor. **Non-Inertial Systems:** Non-inertial frames and fictitious forces. Uniformly rotating frame. Laws of Physics in rotating coordinate systems. Centrifugal force. Coriolis force and its applications. Components of Velocity and Acceleration in Cylindrical and Spherical Coordinate Systems.
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching
Paper Code/Title	**Paper Title:** DIGITAL ELECTRONICS **Paper Code: C-7**
Allotted Unit/Topic	Introduction to CRO, Integrated Circuits, Digital Circuits, Boolean Algebra, Data Processing Circuits, Arithmetic Circuits, Sequential Circuits, Timers, Shift Registers.
Number of Classes	38
Details of the topic	**Introduction to CRO:** Block Diagram of CRO. Electron Gun, Deflection System and Time Base. Deflection Sensitivity. Applications of CRO: (1) Study of Waveform, (2) Measurement of Voltage, Current, Frequency, and Phase Difference. **Integrated Circuits:**(Qualitative treatment only): Active & Passive components. Discrete components. Wafer. Chip. Advantages and drawbacks of ICs. Scale of integration: SSI, MSI, LSI and VLSI (basic idea and definitions only). Classification of ICs. Examples of Linear and Digital ICs. **Digital Circuits:** Difference between Analog and Digital Circuits. Binary Numbers. Decimal to Binary and Binary to Decimal Conversion. BCD, Octal and Hexadecimal numbers. AND, OR and NOT Gates (realization using Diodes and Transistor). NAND and NOR Gates as Universal Gates.

	XOR and XNOR Gates and application as Parity Checkers. **Boolean algebra:** De Morgan's Theorems. Boolean Laws. Simplification of Logic Circuit using Boolean Algebra. Fundamental Products. Idea of Minterms and Maxterms. Conversion of a Truth table into Equivalent Logic Circuit by (1) Sum of Products Method and (2) Karnaugh Map. **Data processing circuits**: Basic idea of Multiplexers, De-multiplexers, Decoders, Encoders **Arithmetic Circuits:** Binary Addition. Binary Subtraction using 2's Complement. Half and Full Adders. Half & Full Subtractors, 4-bit binary Adder/Subtractor. **Sequential Circuits:** SR, D, and JK Flip-Flops. Clocked (Level and Edge Triggered) Flip-Flops. Preset and Clear operations. Race-around conditions in JK Flip-Flop. M/S JK Flip-Flop. **Timers**: IC 555: block diagram and applications: Astable multivibrator and Monostable multivibrator. **Shift registers:** Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits).
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching
Paper Code/Title	**Title Paper:** SOLID STATE PHYSICS **Paper Code: C-12**
Allotted Unit/Topic	Dielectric Properties of Matter, Ferroelectric Properties of Matter, Elementary Band Theory.
Number of Classes	24

Details of the topic	**Dielectric Properties of Materials:** Polarization. Local Electric Field at an Atom. Depolarization Field. Electric Susceptibility. Polarizability. Clausius Mosotti Equation. Classical Theory of Electric Polarizability. Normal and Anomalous Dispersion. Cauchy and Sellmeir relations. Langevin-Debye equation. Complex Dielectric. Constant. Optical Phenomena. Application: Plasma Oscillations, Plasma Frequency, Plasmons, TO modes. **Ferroelectric Properties of Materials:** Structural phase transition, Classification of crystals, Piezoelectric effect, Pyroelectric effect, Ferroelectric effect, Electrostrictive effect, Curie-Weiss Law, Ferroelectric domains,PE hysteresis loop. **Elementary band theory:** Kronig Penny model. Band Gap. Conductor, Semiconductor (P and N type) and insulator. Conductivity of Semiconductor, mobility, Hall Effect. Measurement of conductivity (04 probe method) & Hall coefficient
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching
Paper Code/Title	Paper Title: CLASSICAL DYNAMICS Paper Code: DSE-1
Allotted Unit/Topic	Classical Mechanics of Point particle, Small Amplitude Oscillation.
Number of Classes	32
Details of the topic	**Classical Mechanics of Point Particles**: Review of Newtonian Mechanics; Application to the motion of a charge particle in external electric and magnetic fields- motion in uniform electric field, magnetic field- gyroradius and gyrofrequency, motion in crossed electric and magnetic fields. Generalized coordinates and velocities, Hamilton's principle, Lagrangian and the Euler-Lagrange equations, one-dimensional examples of the Euler-Lagrange equations- one-dimensional Simple Harmonic Oscillations and falling body in uniform gravity; applications to simple systems such as coupled oscillators Canonical momenta & Hamiltonian. Hamilton's equations of motion. Applications: Hamiltonian for a harmonic oscillator, solution of Hamilton's equation for Simple Harmonic Oscillations; particle in a central force field- conservation of angular momentum and energy. **Small Amplitude Oscillations:** Minima of potential energy and points of stable equilibrium, expansion of the potential energy around a minimum, small amplitude oscillations about the minimum, normal modes of oscillations example of N identical masses connected in a linear fashion to (N -1) - identical springs.
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.

Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching
Paper Code/Title	Paper Title: MECHANICS Paper Code: GE-1
Allotted Unit/Topic	Gravitation and Oscilation.
Number of Classes	14
Details of the topic	**Gravitation:** Newton's Law of Gravitation. Motion of a particle in a central force field (motion is in a plane, angular momentum is conserved, areal velocity is constant). Kepler's Laws (statement only). Satellite in circular orbit and applications. Geosynchronous orbits. Basic idea of global positioning system (GPS). Weightlessness. Physiological effects on astronauts. **Oscillations:** Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations.
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching
Paper Code/Title	Paper Title: **THERMAL PHYSICS AND STATISTICAL MECHANICS** Paper Code: GE-3
Allotted Unit/Topic	Kinetic theory of gas.
Number of Classes	10
Details of the topic	**Kinetic Theory of Gases:** Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono- atomic and diatomic gases.
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching

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DESIGNATION: ASSISTANT PROFESSOR
SESSION: JAN - JUNE 2023

TEACHING PLAN FOR EVEN SEMESTER

Paper Code/Title	Paper Title: WAVES AND OPTICS Paper Code: C-4
Allotted Unit/Topic	Superposition of Collinear Harmonic Oscillation, Superposition of Two Perpendicular Harmonic Oscillations, Wave Motion, Velocity of Waves, Superposition of two Harmonic Waves.
Number of Classes	24
Details of the topic	**Superposition of Collinear Harmonic oscillations**: Linearity and Superposition Principle. Superposition of two collinear oscillations having (1) equal frequencies and (2) different frequencies (Beats). Superposition of N collinear Harmonic Oscillations with (1) equal phase differences and (2) equal frequency differences. **Superposition of two perpendicular Harmonic Oscillations**: Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their use. **Wave Motion:** Plane and Spherical Waves. Longitudinal and Transverse Waves. Plane Progressive (Travelling) Waves. Wave Equation. Particle and Wave Velocities. Differential Equation. Pressure of a Longitudinal Wave. Energy Transport. Intensity of Wave. Water Waves: Ripple and Gravity Waves. **Velocity of Waves:** Velocity of Transverse Vibrations of Stretched Strings. Velocity of Longitudinal Waves in a Fluid in a Pipe. Newton's Formula for Velocity of Sound. Laplace's Correction. **Superposition of Two Harmonic Waves**: Standing (Stationary) Waves in a String: Fixed and Free Ends. Analytical Treatment. Phase and Group Velocities. Changes with respect to Position and Time. Energy of Vibrating String. Transfer of Energy. Normal Modes of Stretched Strings. Plucked and Struck Strings. Melde's Experiment. Longitudinal Standing Waves and Normal Modes. Open and Closed Pipes. Superposition of N Harmonic Waves.
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching
Paper Code/Title	Paper Title: MECHANICS Paper Code: GE-2
Allotted Unit/Topic	Electrostatics
Number of Classes	22
Details of the topic	**Electrostatics:** Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere. Calculation of electric field from potential. Capacitance of an isolated spherical conductor. Parallel

	plate, spherical and cylindrical condenser. Energy per unit volume in electrostatic field. Dielectric medium, Polarisation, Displacement vector. Gauss's theorem in dielectrics. Parallel plate capacitor completely filled with dielectric.
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching
Paper Code/Title	Paper Title: ANALOG SYSTEMS AND APPLICATIONS Paper Code: C-10
Allotted Unit/Topic	Semiconductor Diode, Two Terminal Devices and Application, Bipolar Junction Transistor, Amplifiers, Coupled Amplifier, Feedback in Amplifier.
Number of Classes	40
Details of the topic	**Semiconductor Diodes:** P and N type semiconductors. Energy Level Diagram. Conductivity and Mobility, Concept of Drift velocity. PN Junction Fabrication (Simple Idea). Barrier Formation in PN Junction Diode. Static and Dynamic Resistance. Current Flow Mechanism in Forward and Reverse Biased Diode. Drift Velocity. Derivation for Barrier Potential, Barrier Width and Current for Step Junction. Current Flow Mechanism in Forward and Reverse Biased Diode. **Two-terminal Devices and their Applications:** (1) Rectifier Diode: Half-wave Rectifiers. Centre-tapped and Bridge Full-wave Rectifiers, Calculation of Ripple Factor and Rectification Efficiency, C-filter (2) Zener Diode and Voltage Regulation. Principle and structure of (1) LEDs, (2) Photodiode and (3) Solar Cell. **Bipolar Junction transistors:** n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations. Current gains α and β Relations between α and β. Load Line analysis of Transistors. DC Load line and Q-point. Physical Mechanism of Current Flow. Active, Cutoff and Saturation Regions. **Amplifiers:** Transistor Biasing and Stabilization Circuits. Fixed Bias and Voltage Divider Bias. Transistor as 2-port Network. h-parameter Equivalent Circuit. Analysis of a single-stage CE amplifier using Hybrid Model. Input and Output Impedance. Current, Voltage and Power Gains. Classification of Class A, B & C Amplifiers. **Coupled amplifiers**: Two stage RC coupled Amplifier and its frequency response. **Feedback in Amplifiers:** Effect of positive and negative feedback on Input impedence, Output impedence, Gain , Stability, Distortion and noise.
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching

Paper Code/Title	Paper Title: NUCLEAR AND PARTICLE PHYSICS Paper Code: DSE-3
Allotted Unit/Topic	General Properties of Nuclei, Nuclear Models, Radioactive Decay, Nuclear Reaction, Particle Physics.
Number of Classes	40
Details of the topic	**General Properties of Nuclei**: Constituents of nucleus and their Intrinsic properties, quantitative facts about mass, radii, charge density (matter density), binding energy, average binding energy and its variation with mass number, main features of binding energy versus mass number curve, N/A plot, angular momentum, parity, magnetic moment, electric moments, nuclear excites states. **Nuclear Models**: Liquid drop model approach, semi empirical mass formula and significance of its various terms, condition of nuclear stability, two nucleon separation energies, Fermi gas model (degenerate fermion gas, nuclear symmetry potential in Fermi gas), evidence for nuclear shell structure, nuclear magic numbers, basic assumption of shell model, concept of mean field, residual interaction, concept of nuclear force. **Radioactivity decay**: (a) Alpha decay: basics of α-decay processes, theory of α-emission, Gamow factor, Geiger Nuttall law, α-decay spectroscopy. (b) □-decay: energy kinematics for □-decay, positron emission, electron capture, neutrino hypothesis. (c) Gamma decay: Gamma rays emission & kinematics, internal conversion. **Nuclear Reactions:** Types of Reactions, Conservation Laws, kinematics of reactions, Q-value, reaction rate, reaction cross section, Concept of compound and direct Reaction, resonance reaction, Coulomb scattering (Rutherford scattering).
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching

Signature
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NAME OF THE TEACHER: MR. GUNA KANTA SONOWAL
DESIGNATION: ASSISTANT PROFESSOR
SESSION: JULY - DECEMBER 2022

TEACHING PLAN
2022-23

MR. GUNA KANTA SONOWAL
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TEACHING PLAN FOR ODD SEMESTER

Paper Code/Title	**Paper Title:** Mathematical Physics-1 **Paper Code: C-1**
Allotted Unit/Topic	Vector Calculus, Vector differentiation, Vector integration.
Number of Classes	27
Details of the topic	Recapitulation of vectors: Properties of vectors under rotations. Scalar product and its invariance under rotations. Vector product, Scalar triple product and their interpretation in terms of area and volume respectively. Scalar and Vector fields. Vector Differentiation: Directional derivatives and normal derivative. Gradient of a scalar field and its geometrical interpretation. Divergence and curl of a vector field. Del and Laplacian operators. Vector identities. Vector Integration: Ordinary Integrals of Vectors. Multiple integrals, Jacobian. Notion of infinitesimal line, surface and volume elements. Line, surface and volume integrals of Vector fields. Flux of a vector field. Gauss' divergence theorem, Green's and Stokes Theorems and their applications (no rigorous proofs).
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching
Paper Code/Title	**Paper Title:** MECHANICS **Paper Code: GE-1**
Allotted Unit/Topic	Vector, Ordinary differential Equation.
Number of Classes	10
Details of the topic	**Vectors:** Vector algebra. Scalar and vector products. Derivatives of a vector with respect to a parameter. **Ordinary Differential Equations:** 1st order homogeneous differential equations. 2nd order homogeneous differential equations with constant coefficients.
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching
Paper Code/Title	**Title Paper:** Thermal Physics **Paper Code: C-6**
Allotted Unit/Topic	Thermodynamic Potential, Maxwell's Thermodynamic Relations, Kinetic Theory of Gasses, Distribution of velocities, Molecular Collisions, Real Gases.
Number of Classes	35

Details of the topic	**Thermodynamic Potentials**: Thermodynamic Potentials: Internal Energy, Enthalpy, Helmholtz Free Energy, Gibb's Free Energy. Their Definitions, Properties and Applications. Surface Films and Variation of Surface Tension with Temperature. Magnetic Work, Cooling due to adiabatic demagnetization, First and second order Phase Transitions with examples, Clausius Clapeyron Equation and Ehrenfest equations . **Maxwell's Thermodynamic Relations**: Derivations and applications of Maxwell's Relations, Maxwell's Relations:(1) Clausius Clapeyron equation, (2) Values of Cp-Cv, (3) TdS Equations, (4) Joule-Kelvin coefficient for Ideal and Van der Waal Gases, (5) Energy equations, (6) Change of Temperature during Adiabatic Process. **Distribution of Velocities**: Maxwell-Boltzmann Law of Distribution of Velocities in an Ideal Gas and its Experimental Verification. Doppler Broadening of Spectral Lines and Stern's Experiment. Mean, RMS and Most Probable Speeds. Degrees of Freedom. Law of Equipartition of Energy (No proof required). Specific heats of Gases. **Molecular Collisions**: Mean Free Path. Collision Probability. Estimates of Mean Free Path. Transport Phenomenon in Ideal Gases: (1) Viscosity, (2) Thermal Conductivity and (3) Diffusion. Brownian Motion and its Significance. **Real Gases:** Behavior of Real Gases: Deviations from the Ideal Gas Equation. The Virial Equation. Andrew's Experiments on CO2 Gas. Critical Constants. Continuity of Liquid and Gaseous State. Vapour and Gas. Boyle Temperature. Van der Waal's Equation of State for Real Gases. Values of Critical Constants. Law of Corresponding States. Comparison with Experimental Curves. P-V Diagrams. Joule's Experiment. Free Adiabatic Expansion of a Perfect Gas. Joule-Thomson Porous Plug Experiment. Joule- Thomson Effect for Real and Van der Waal Gases. Temperature of Inversion. Joule- Thomson Cooling.
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching
Paper Code/Title	Paper Title: Thermal Physics and Statistical Mechanics Paper Code: GE-3
Allotted Unit/Topic	Statistical Mechanics.
Number of Classes	12
Details of the topic	**Statistical Mechanics:** Phase space, Macrostate and Microstate, Entropy and Thermodynamic probability, Maxwell-Boltzmann law - distribution of velocity - Quantum statistics - Fermi-Dirac distribution law - electron gas - Bose-Einstein distribution law - photon gas - comparison of three statistics.
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.

Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching
Paper Code/Title	Paper Title: Quantum Mechanics & Applications Paper Code: C-11
Allotted Unit/Topic	Time dependent Schrodinger Equation, Time independent Schrodinger Equation, General discussion of bound states in an arbitrary potential, Quantum theory of hydrogen like atoms, Atoms in Electric and Magnetic fields, Atom in external Magnetic fields, Many electron atoms.
Number of Classes	60
Details of the topic	Time dependent Schrodinger equation and dynamical evolution of a quantum state; Properties of Wave Function. Interpretation of Wave Function Probability and probability current densities in three dimensions; Conditions for Physical Acceptability of Wave Functions. Normalization. Linearity and Superposition Principles. Eigenvalues and Eigenfunctions. Position, momentum and Energy operators; commutator of position and momentum operators; Expectation values of position and momentum. Wave Function of a Free Particle. Time dependent Schrodinger equation and dynamical evolution of a quantum state; Properties of Wave Function. Interpretation of Wave Function Probability and probability current densities in three dimensions; Conditions for Physical Acceptability of Wave Functions. Normalization. Linearity and Superposition Principles. Eigenvalues and Eigenfunctions. Position, momentum and Energy operators; commutator of position and momentum operators; Expectation values of position and momentum. Wave Function of a Free Particle. **General discussion of bound states in an arbitrary potential**- continuity of wave function, boundary condition and emergence of discrete energy levels; application to one-dimensional problem-square well potential; Quantum mechanics of simple harmonic oscillator-energy levels and energy eigen functions using Frobenius method; Hermite polynomials; ground state, zero point energy & uncertainty principle. **Quantum theory of hydrogen-like atoms**: time independent Schrodinger equation in spherical polar coordinates; separation of variables for second order partial differential equation; angular momentum operator & quantum numbers; Radial wave functions from Frobenius method; shapes of the probability densities for ground & first excited states; Orbital angular momentum quantum numbers l and m; s, p, d... shells. **Atoms in Electric & Magnetic Fields**: Electron angular momentum. Space quantization. Electron Spin and Spin Angular Momentum. Larmor's Theorem. Spin Magnetic Moment. Stern-Gerlach Experiment. Zeeman Effect: Electron Magnetic Moment and Magnetic Energy, Gyromagnetic Ratio and Bohr Magneton. **Atoms in External Magnetic Fields**:- Normal and Anomalous Zeeman Effect. Paschen Back and Stark Effect (Qualitative Discussion only). **Many electron atoms**: Pauli's Exclusion Principle. Symmetric & Antisymmetric Wave Functions. Periodic table. Fine structure. Spin orbit coupling. Spectral Notations for Atomic States. Total angular momentum. Vector Model. Spin-orbit

	coupling in atoms-L-S and J-J couplings. Hund's Rule. Term symbols. Spectra of Hydrogen and Alkali atoms (Na etc.)
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching

NAME OF THE TEACHER: MR. GUNA KANTA SONOWAL
DESIGNATION: ASSISTANT PROFESSOR
SESSION: JAN - JUNE 2023

TEACHING PLAN FOR EVEN SEMESTER

Paper Code/Title	Paper Title: Electricity and Magnetism Paper Code: C-3
Allotted Unit/Topic	Electric Field and Electric Potential, Dielectric properties of Matter
Number of Classes	30
Details of the topic	Electric field: Electric field lines. Electric flux. Gauss' Law with applications to charge distributions with spherical, cylindrical and planar symmetry. Conservative nature of Electrostatic Field. Electrostatic Potential. Laplace's and Poisson equations. The Uniqueness Theorem. Potential and Electric Field of a dipole. Force and Torque on a dipole. Electrostatic energy of system of charges. Electrostatic energy of a charged sphere. Conductors in an electrostatic Field. Surface charge and force on a conductor. Capacitance of a system of charged conductors. Parallel-plate capacitor. Capacitance of an isolated conductor. Method of Images and its application to (1) Plane Infinite Sheet and (2) Sphere. **Dielectric Properties of Matter:** Electric Field in matter. Polarization, Polarization Charges. Electrical Susceptibility and Dielectric Constant. Capacitor (parallel plate, spherical, cylindrical) filled with dielectric. Displacement vector **D**. Relations between **E**,**P** and **D**. Gauss' Law in dielectrics.
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching
Paper Code/Title	Paper Title: Electricity and Magnetism Paper Code: GE-2
Allotted Unit/Topic	**Vector Analysis**
Number of Classes	12
Details of the topic	**Vector Analysis**: Review of vector algebra (Scalar and Vector product), gradient, divergence, Curl and their significance, Vector Integration, Line, surface and volume integrals of Vector fields, Gauss-divergence theorem and Stoke's theorem of vectors (statement only).
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching
Paper Code/Title	Paper Title: Mathematical physics-III Paper Code: C-8

Allotted Unit/Topic	Complex Analysis.
Number of Classes	30
Details of the topic	Brief Revision of Complex Numbers and their Graphical Representation. Euler's formula, De Moivre's theorem, Roots of Complex Numbers. Functions of Complex Variables. Analyticity and Cauchy-Riemann Conditions. Examples of analytic functions. Singular functions: poles and branch points, order of singularity, branch cuts. Integration of a function of a complex variable. Cauchy's Inequality. Cauchy's Integral formula. Simply and multiply connected region. Laurent and Taylor's expansion. Residues and Residue Theorem. Application in solving Definite Integrals.
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching
Paper Code/Title	Paper Title: Wave and Optics Paper Code: GE-4
Allotted Unit/Topic	Sound
Number of Classes	10
Details of the topic	**Sound:** Simple harmonic motion - forced vibrations and resonance - Fourier's Theorem - Application to saw tooth wave and square wave - Intensity and loudness of sound - Decibels - Intensity levels - musical notes - musical scale. Acoustics of buildings: Reverberation and time of reverberation - Absorption coefficient - Sabine's formula - measurement of reverberation time - Acoustic aspects of halls and auditoria.
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching
Paper Code/Title	Paper Title: Electromagnetic Theory Paper Code: C-13
Allotted Unit/Topic	Polarization of electromagnetic waves.
Number of Classes	12
Details of the topic	**Polarization of Electromagnetic Waves:** Description of Linear, Circular and Elliptical Polarization. Propagation of E.M. Waves in Anisotropic Media. Symmetric Nature of Dielectric Tensor. Fresnel's Formula. Uniaxial and Biaxial Crystals. Light Propagation in Uniaxial Crystal. Double Refraction. Polarization by Double Refraction. Nicol Prism. Ordinary & extraordinary refractive indices. Production & detection of Plane, Circularly and Elliptically Polarized Light. Phase Retardation Plates: Quarter-Wave and Half-Wave Plates. Babinet Compensator and its Uses. Analysis of Polarized Light

Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching
Paper Code/Title	Paper Title: Statistical Mechanics Paper Code: C-14
Allotted Unit/Topic	Classical statistics, Classical theory of radiation, Quantum theory of radiation.
Number of Classes	32
Details of the topic	**Classical Statistics:** Macrostate & Microstate, Elementary Concept of Ensemble, Phase Space, Entropy and Thermodynamic Probability, Maxwell-Boltzmann Distribution Law, Partition Function, Thermodynamic Functions of an Ideal Gas, Classical Entropy Expression, Gibbs Paradox, Sackur Tetrode equation, Law of Equipartition of Energy (with proof) – Applications to Specific Heat and its Limitations, Thermodynamic Functions of a Two-Energy Levels System, Negative Temperature. **Classical Theory of Radiation:** Properties of Thermal Radiation. Blackbody Radiation. Pure temperature dependence. Kirchhoff's law. Stefan-Boltzmann law: Thermodynamic proof. Radiation Pressure. Wien's Displacement law. Wien's Distribution Law. Saha's Ionization Formula. Rayleigh-Jean's Law. Ultraviolet Catastrophe. **Quantum Theory of Radiation:** Spectral Distribution of Black Body Radiation. Planck's Quantum Postulates. Planck's Law of Blackbody Radiation: Experimental Verification. Deduction of (1) Wien's Distribution Law, (2) Rayleigh-Jeans Law, (3) Stefan-Boltzmann Law, (4) Wien's Displacement law from Planck's law.
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching

(Guna Kanta Sonowal)

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NAME OF THE TEACHER:JAYANTA SONOWAL
DESIGNATION: ASSISTANT PROFESSOR
SESSION: JULY - DECEMBER 2023

TEACHING PLAN

2022-23

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TEACHING PLAN FOR ODD SEMESTER

Semester	First Semester (Honours)
Paper Code/Title	**Paper Code:** C2 **Paper Title:** Mechanics
Allotted Unit/Topic	Fundamentals of Dynamics, Work and Energy, Collisions, Rotational Dynamics, Elasticity.
Number of Classes	17
Details of the topic	**Fundamentals of Dynamics:** Reference frames. Inertial frames; Review of Newton's Laws of Motion. Galilean transformations; Galilean invariance. Momentum of variable-mass system: motion of rocket. Motion of a projectile in Uniform gravitational field Dynamics of a system of particles. Centre of Mass. Principle of conservation of momentum. Impulse. **Work and Energy:** Work and Kinetic Energy Theorem. Conservative and non-conservative forces. Potential Energy. Energy diagram. Stable and unstable equilibrium. Elastic potential energy. Force as gradient of potential energy. Work & Potential energy. Work done by non-conservative forces. Law of conservation of Energy. **Collisions:** Elastic and inelastic collisions between particles. Centre of Mass and laboratory frame. **Rotational Dynamics:** Angular momentum of particles and system of particles, Torque. Principle of conservation of angular momentum. Rotation about a fixed axis. Moment of Inertia. Calculation of moment of inertia for rectangular, cylindrical and spherical bodies. Kinetic energy of rotation. Motion involving both translation and rotation. **Elasticity:** Relation between Elastic constants. Twisting torque on a Cylinder or Wire.
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like Google Classroom, Google Meet etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion
Semester	First Semester (Generic)

Paper Code/Title	**Paper Code:** GE-1 **Paper Title:** *Mechanics*
Allotted Unit/Topic	Laws of motion.
Number of Classes	10
Details of the topic	**Laws of motion:** Frames of reference. Newton's Laws of motion. Dynamics of a system of particles. Centre of Mass.
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like Google Classroom, Google Meet etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion
Semester	Third Semester (Honours)
Paper Code/Title	**Paper Code:** C-V **Paper Title:** Mathematical Physics-II
Allotted Unit/Topic	Theory of Errors, Partial Differential Equations.
Number of Classes	21
Details of the topic	**Theory of Errors:** Systematic and Random Errors. Propagation of Errors. Normal Law of Errors. Standard and Probable Error. Least-squares fit. Error on the slope and intercept of a fitted line. **Partial Differential Equations:** Solutions to partial differential equations, using separation of variables: Laplace's Equation in problems of rectangular, cylindrical and spherical symmetry. Wave equation and its solution for vibrational modes of a stretched string, rectangular and circular membranes. Diffusion Equation.
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like Google Classroom, Google Meet etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion
Semester	Third Semester (Honours)

Paper Code/Title	**Paper Code:** C-VII **Paper Title:** Digital Systems and Applications.
Allotted Unit/Topic	Computer Organization, Intel 8085 Microprocessor Architecture, Introduction to Assembly Language.
Number of Classes	18
Details of the topic	**Computer Organization:** Input/ Output Devices. Data storage (idea of RAM and ROM). Computer memory. Memory organization & addressing. Memory Interfacing. Memory Map. **Intel 8085 Microprocessor Architecture:** Main features of 8085. Block diagram. Components. Pin-out diagram. Buses. Registers. ALU. Memory. Stack memory. Timing & Control circuitry. Timing states. Instruction cycle, Timing diagram of MOV and MVI. **Introduction to Assembly Language:** 1 byte, 2 byte & 3 byte instruction.
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like Google Classroom, Google Meet etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion
Semester	Third Semester (Generic)
Paper Code/Title	**Paper Code:** GE-3 **Paper Title:** Thermal Physics and Statistical Mechanics.
Allotted Unit/Topic	Thermodynamic Potentials.
Number of Classes	10
Details of the topic	**Thermodynamic Potentials:** Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations and applications - JouleThompson Effect, Clausius-Clapeyron Equation, Expression for (CP – CV), CP/CV, TdS equations.
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like Google Classroom, Google Meet etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion

Semester	Fifth Semester (Honours)
Paper Code/Title	**Paper Code:** DSE-2 **Paper Title:** Astronomy and Astrophysics
Allotted Unit/Topic	Astronomical Scales, Basic concepts of positional astronomy, Astronomical techniques, Physical principles, Galaxies, Large scale structure & expanding universe.
Number of Classes	50
Details of the topic	**Astronomical Scales:** Astronomical Distance, Mass and Time, Scales, Brightness, Radiant Flux and Luminosity, Measurement of Astronomical Quantities Astronomical Distances, Stellar Radii, Masses of Stars, Stellar Temperature. **Basic concepts of positional astronomy**: Celestial Sphere, Geometry of a Sphere, Spherical Triangle Astronomical Coordinate Systems, Geographical Coordinate Systems, Horizon System, Equatorial System, Diurnal Motion of the Stars, Conversion of Coordinates. Measurement of Time, Sidereal Time, Apparent Solar Time, Mean Solar Time, Equation of Time, Calendar. Basic Parameters of Stars: Determination of Distance by Parallax Method; Brightness, Radiant Flux and Luminosity, Apparent and Absolute magnitude scale, Distance Modulus; Determination of Temperature and Radius of a star; Determination of Masses from Binary orbits; Stellar Spectral Classification, Hertzsprung-Russell Diagram. **Astronomical techniques:** Basic Optical Definitions for Astronomy (Magnification Light Gathering Power, Resolving Power and Diffraction Limit, Atmospheric Windows), Optical Telescopes (Types of Reflecting Telescopes, Telescope Mountings, Space Telescopes, Detectors and Their Use with Telescopes (Types of Detectors, detection Limits with Telescopes). **Physical principles:** Gravitation in Astrophysics (Virial Theorem, Newton versus Einstein), Systems in Thermodynamic Equilibrium. **Galaxies:** Galaxy Morphology, Hubble's Classification of Galaxies, Elliptical Galaxies (The Intrinsic Shapes of Elliptical, de Vaucouleurs Law, Stars and Gas). Spiral and Lenticular Galaxies (Bulges, Disks, Galactic Halo) The Milky Way Galaxy, Gas and Dust in the Galaxy, Spiral Arms. **Large scale structure & expanding universe**: Cosmic Distance Ladder (An Example from Terrestrial Physics, Distance Measurement using Cepheid Variables), Hubble's Law (Distance- Velocity Relation), Clusters of Galaxies (Virial theorem and Dark Matter).
Teaching Tools	• Board and Marker
	• ICT tools like Projector, online platform like Google Classroom, Google Meet etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion

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NAME OF THE TEACHER:JAYANTA SONOWAL
DESIGNATION: ASSISTANT PROFESSOR
SESSION: JAN - JUNE 2023

TEACHING PLAN FOR EVEN SEMESTER

Semester	Second Semester (Honours)
Paper Code/Title	**Paper Code:** C4 **Paper Title:** *Wave and Optics*
Allotted Unit/Topic	Wave and Optics, Interference, Interferometer, Diffraction, Fraunhofer Diffraction.
Number of Classes	26
Details of the topic	**Wave and Optics:** Electromagnetic nature of light, definition and properties of wave front, Huygens principle, Temporal and Spatial coherence. **Interference:** Division of amplitude and wavefront, Young's double slit experiment, Lloyd's Mirror and Fresnel's Biprism, Phase change on reflection: Stokes' treatment, Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes), Newton's Rings: Measurement of wavelength and refractive index. **Interferometer:** Michelson Interferometer-(1) Idea of form of fringes (No theory required), (2) Determination of Wavelength, (3) Wavelength Difference, (4)Refractive Index, and (5) Visibility of Fringes. Fabry Perot interferometer. **Diffraction:** Kirchhoff's Integral Theorem, Fresnel-Kirchhoff's Integral formula. (Qualitative discussion only) **Fraunhofer Diffraction:** Single slit. Circular aperture, Resolving Power of a telescope, Double slit, Multiple slits, Diffraction grating. Resolving power of grating.
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like Google Classroom,

	Google Meet etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion
Semester	Second Semester (Generic)
Paper Code/Title	**Paper Code:** GE-4 **Paper Title:** *Electricity and Magnetism*
Allotted Unit/Topic	Magnetism
Number of Classes	10
Details of the topic	**Magnetostatics:** Biot-Savart's law and its applications- straight conductor, circular coil, solenoid carrying current. Divergence and curl of magnetic field. Magnetic vector potential. Ampere's circuital law. Magnetic properties of materials: Magnetic intensity, magnetic induction, permeability, magnetic susceptibility. Brief introduction of dia-, para-and ferro-magnetic materials.
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like Google Classroom, Google Meet etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion
Semester	Forth Semester (Honours)
Paper Code/Title	**Paper Code:** C-IX **Paper Title:** Elements of Modern Physics
Allotted Unit/Topic	Size structure of atomic nucleus, Radioactivity, Fission and Fusion, Lasers.
Number of Classes	21
Details of the topic	**Size structure of atomic nucleus:** Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle. Nature of nuclear force, NZ graph, Liquid Drop model: semi-empirical mass formula and binding energy, Nuclear Shell Model and magic numbers. **Radioactivity:** stability of the nucleus; Law of radioactive decay; Mean life and half-life; Alpha decay;Beta decay- energy released, spectrum and Pauli's prediction of neutrino; Gamma ray emission, energy-momentum conservation : electron-positron pair creation by gamma photons in the vicinity of a nucleus.

	Paper Title: Wave and Optics
Allotted Unit/Topic	Wave and Optics, Interference.
Number of Classes	13
Details of the topic	**Wave and Optics:** Electromagnetic nature of light. Definition and Properties of wave front. Huygens Principle. **Interference:** Interference: Division of amplitude and division of wavefront. Young's Double Slit experiment. Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes' treatment. Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes). Newton's Rings: measurement of wavelength and refractive index.
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like Google Classroom, Google Meet etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion
Semester	Sixth Semester (Honours)
Paper Code/Title	**Paper Code:** DSE-4 **Paper Title:** Nano Materials and Application
Allotted Unit/Topic	Synthesis of nanostructure materials, Characterization, Optical properties, Electron transport, Applications.
Number of Classes	40
Details of the topic	**Synthesis of nanostructure materials:** Top down and Bottom up approach, Photolithography. Ball milling. Gas phase condensation. Vacuum deposition. Physical vapor deposition (PVD): Thermal evaporation, E-beam evaporation, Pulsed Laser deposition. Chemical vapor deposition (CVD). Sol-Gel. Electro deposition. Spray pyrolysis. Hydrothermal synthesis. Preparation through colloidal methods. MBE growth of quantum dot. **Characterization:** X- ray diffraction, Optical Microscopy, Scanning electron Microscopy , Transmission Electron Microscopy , Atomic Force Microscopy, Scanning Tunneling Microscopy. **Optical properties**: Coulomb interaction in nanostructures. Concept of dielectric constant for nanostructures and charging of nanostructure. Quasi-particles and excitons. Excitons in direct and indirect band gap semiconductor nanocrystals. Quantitative treatment of quasi-particles and excitons, charging

	effects. Radiative Processes: General formalization-absorption, emission and luminescence, Optical properties of hetero structures and nano structures. **Electron transport:** Carrier transport in nanostrcutures. Coulomb blockade effect, thermionic emission, tunneling and hoping conductivity. Defects and impurities: Deep level and surface defects. **Applications:** Applications of nanoparticles, quantum dots, nanowires and thin films for photonic devices (LED, solar cells). Single electron transfer devices (no derivation). CNT based transistors. Nanomaterial Devices: Quantum dots heterostructure lasers, optical switching and optical data storage. Magnetic quantum well; magnetic dots - magnetic data storage. Micro Electromechanical Systems (MEMS), Nano Electromechanical Systems (NEMS)
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like Google Classroom, Google Meet etc.
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion

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NAME OF THE TEACHER: DR. GITASHRI ARANDHARA
DESIGNATION: ASSISTANT PROFESSOR
SESSION: JULY - DECEMBER 2022

TEACHING PLAN

2022-23

Dr. Gitashri Arandhara
Assistant Professor
Department of Physics
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TEACHING PLAN FOR ODD SEMESTER

Semester	**First Semester (Honours)**	
Paper Code/Title	**Paper Title: MATHEMATICAL PHYSICS (THEORY)** **Paper Code: PHYSICS-C I**	
Allotted Unit/Topic	**Calculus**	
Number of Classes	21	
Details of the topic	Recapitulation: Limits, continuity, average and instantaneous quantities, differentiation. Plotting functions. Intuitive ideas of continuous, differentiable, etc. functions and plotting of curves. Approximation: Taylor and binomial series (statements only). First Order and Second Order Differential equations: First Order Differential Equations and Integrating Factor. Homogeneous Equations with constant coefficients. Wronskian and general solution. Statement of existence and Uniqueness Theorem for Initial Value Problems. Particular Integral. Calculus of functions of more than one variable: Partial derivatives, exact and inexact differentials. Integrating factor, with simple illustration. Constrained Maximization using Lagrange Multipliers.	
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, GoogleClassroom etc.	
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching	
Semester	**First Semester (Generic)**	
Paper Code/Title	**Paper Title: MECHANICS (THEORY)** **Paper Code: GE-1**	
Allotted Unit/Topic	**Momentum and Energy**	**Rotational Motion**
Number of Classes	**6**	**5**
Details of the topic	Conservation of momentum, Work and energy, Conservation of energy, Motion of rockets.	Angular velocity and angular momentum, Torque, Conservation of angular momentum.
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.	
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz Seminar Presentation/Group Discussion/Micro Teaching	
Semester	**Third Semester (Honours)**	
Paper Code/Title	**Paper Title: T H E R M A L P H Y S I C S (THEORY)** **Paper Code: PHYSICS-C VI**	
Allotted Unit/Topic	**Zeroth and First Law of Thermodynamics**	

Number of Classes	**8**	
Details of the topic	Extensive and intensive Thermodynamic Variables, Thermodynamic Equilibrium, Zeroth Law of Thermodynamics & Concept of Temperature, Concept of Work & Heat, State Functions, First Law of Thermodynamics and its differential form, Internal Energy, First Law & various processes, Applications of First Law: General Relation between CP and CV, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Co-efficient.	
Allotted Unit/Topic	**Second Law of Thermodynamics**	**Entropy**
Number of Classes	**10**	**7**
Details of the topic	Reversible and Irreversible process with examples. Conversion of Work into Heat and Heat into Work. Heat Engines. Carnot's Cycle, Carnot engine & efficiency. Refrigerator & coefficient of performance, 2nd Law of Thermodynamics: Kelvin-Planck and Clausius Statements and their Equivalence. Carnot's Theorem. Applications of Second Law of Thermodynamics: Thermodynamic Scale of Temperature and its Equivalence to Perfect Gas Scale.	Concept of Entropy, Clausius Theorem. Clausius Inequality, Second Law of Thermodynamics in terms of Entropy. Entropy of a perfect gas. Principle of Increase of Entropy. Entropy Changes in Reversible and Irreversible processes with examples. Entropy of the Universe. Entropy Changes in Reversible and Irreversible Processes. Principle of Increase of Entropy. Temperature–Entropy diagrams for Carnot's Cycle. Third Law of Thermodynamics. Unattainability of Absolute Zero.
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, GoogleClassroom etc.	
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching	
Semester	**Third Semester (Generic)**	
Paper Code/Title	**Paper Title: Thermal Physics and Statistical Mechanics** **Paper Code: GE-3**	
Allotted Unit/Topic	**Theory of Radiation**	
Number of Classes	**6**	
Details of the topic	Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh-Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's Law.	
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.	
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz	

	• Seminar Presentation/Group Discussion/Micro Teaching

Semester	**Fifth Semester (Honours)**	
Paper Code/Title	**Paper Title: SOLID STATE PHYSICS (THEORY)** **Paper Code: PHYSICS-C-XII**	
Allotted Unit/Topic	**Crystal Structure**	
Number of Classes	12	
Details of the topic	Solids: Amorphous and Crystalline Materials. Lattice Translation Vectors. Lattice with a Basis – Central and Non-Central Elements. Unit Cell. Miller Indices. Reciprocal Lattice. Types of Lattices. Brillouin Zones. Diffraction of X-rays by Crystals. Bragg's Law. Atomic and Geometrical Factor.	
Allotted Unit/Topic	**Elementary Lattice Dynamics**	
Number of Classes	**10**	
Details of the topic	Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains. Acoustical and Optical Phonons. Qualitative Description of the Phonon Spectrum in Solids. Dulong and Petit's Law, Einstein and Debye theories of specific heat of solids. T3 law	
Allotted Unit/Topic	**Magnetic Properties of Matter**	**Superconductivity**
Number of Classes	**8**	**6**
Details of the topic	Dia-, Para-, Ferri- and Ferromagnetic Materials. Classical Langevin Theory of dia– and Paramagnetic Domains. Quantum Mechanical Treatment of Paramagnetism. Curie's law, Weiss's Theory of Ferromagnetism and Ferromagnetic Domains. Discussion of B-H Curve. Hysteresis and Energy Loss.	Experimental Results. Critical Temperature. Critical magnetic field. Meissner effect. Type I and type II Superconductors, London's Equation and Penetration Depth. Isotope effect. Idea of BCS theory (No derivation)
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.	
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching	

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DESIGNATION: ASSISTANT PROFESSOR
SESSION: JAN - JUNE 2023

TEACHING PLAN FOR EVEN SEMESTER

Semester	**Second Semester (Honours)**	
Paper Code/Title	**Paper Title: ELECTRICITY AND MAGNETISM (THEORY)** **Paper Code: PHYSICS-C III**	
Allotted Unit/Topic	**III - Magnetic Field**	**IV - Magnetic Properties of Matter**
Number of Classes	**9**	**4**
Details of the topic	Magnetic force between current elements and definition of Magnetic FieldB. Biot-Savart's Law and its simple applications: straight wire and circular loop. Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole). Ampere's Circuital Law and its application to (1) Solenoid and (2) Toroid. Properties of B: curl and divergence. Vector Potential. Magnetic Force on (1) point charge (2) current carrying wire (3) between current elements. Torque on a current loop in a uniform Magnetic, Field.	Magnetization vector (M). Magnetic Intensity(H). Magnetic Susceptibility and permeability. Relation between B, H, M. Ferromagnetism. B-H curve and hysteresis.
Allotted Unit/Topic	**V - Electromagnetic Induction**	
Number of Classes	4	
Details of the topic	Faraday's Law. Lenz's Law. Self-Inductance and Mutual Inductance. Reciprocity Theorem. Energy stored in a Magnetic Field. Introduction to Maxwell's Equations. Charge Conservation and Displacement current.	
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, GoogleClassroom etc.	
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching	
Semester	**Fourth Semester (Honours)**	
Paper Code/Title	**Paper Title: ELEMENTS OF MODERN PHYSICS (THEORY)** **Paper Code: PHYSICS-C IX**	
Allotted Unit/Topic	**I**	**II**
Number of Classes	**14**	**5**
Details of the topic	Planck's quantum, Planck's constant and light as a collection of photons; Blackbody Radiation: Quantum theory of Light; Photo-	Position measurement- gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle (Uncertainty relations

	electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson-Germer experiment. Wave description of particles by wave packets. Group and Phase velocities and relation between them. Two-Slit experiment with electrons. Probability. Wave amplitude and wave functions	involving Canonical pair of variables): Derivation from Wave Packets impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principleapplication to virtual particles and range of an interaction.
Allotted Unit/Topic	**III**	**IV**
Number of Classes	**10**	**10**
Details of the topic	Two slit interference experiment with photons, atoms and particles; linear superposition principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non-relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of a wave function, probabilities and normalization; Probability and probability current densities in one dimension.	One dimensional infinitely rigid box-energy eigen values and eigen functions, normalization; Quantum dot as example; Quantum mechanical scattering and tunneling in one dimension-across a step potential & rectangular potential barrier.
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, GoogleClassroom etc.	
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching	
Semester	**Second Semester (Generic)**	
Paper Code/Title	**Paper Title: ELECTRICITY AND MAGNETISM (THEORY)** **Paper Code: PHYSICS-GE-2**	
Allotted Unit/Topic	Electrostatics	
Number of Classes	11	
	Electrostatic Field, electric flux, Gauss's theorem of electrostatics. Applications of Gauss theoremElectric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere, plane charged sheet, charged conductor. Electric potential as line integral of electric field, potential due to a point charge, electric dipole, uniformly charged spherical shell and solid sphere.	
Teaching Tools	• Board and Marker ICT tools like Projector, online platform like zoom, Google Classroom etc.	
Evaluation Process	• Sessional Examination • Unit Test	

	• Google Class Room Quiz Seminar Presentation/Group Discussion/Micro Teaching	
Semester	**Fourth Semester (Generic)**	
Paper Code/Title	**Paper Title: W A V E S A N D O P T I C S (THEORY)** **Paper Code: PHYSICS-GE-4**	
Allotted Unit/Topic	**Michelson's Interferometer**	**Polarization**
Number of Classes	**5**	**5**
Details of the topic	Idea of form of fringes (no theory needed), Determination of wavelength, Wavelength difference, Refractive index, and Visibility of fringes.	Transverse nature of light waves. Plane polarized light – production and analysis. Circular and elliptical polarization.
Teaching Tools	• Board and Marker ICT tools like Projector, online platform like zoom, GoogleClassroom etc.	
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz Seminar Presentation/Group Discussion/Micro Teaching	

Semester	**Sixth Semester (Honours)**		
Paper Code/Title	**Paper Title: ELECTROMAGNETIC THEORY** **Paper Code: PHYSICS-C-XIII**		
Allotted Unit/Topic	**I** - Maxwell Equations		
Number of Classes	12		
Details of the topic	Review of Maxwell's equations. Displacement Current. Vector and Scalar Potentials. Gauge Transformations: Lorentz and Coulomb Gauge. Boundary Conditions at Interface between Different Media. Wave Equations. Plane Waves in Dielectric Media. Poynting Theorem and Poynting Vector. Electromagnetic (EM) Energy Density. Physical Concept of Electromagnetic Field Energy Density, Momentum Density and Angular Momentum Density.		
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.		
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching		
Paper Code/Title	**Paper Title: NUCLEAR AND PARTICLE PHYSICS (THEORY)** **Paper Code: PHYSICS-DSE 3**		
Allotted Unit/Topic	**V** - Interaction of Nuclear Radiation with matter	**VI**- Detector for Nuclear Radiations	**VII**- Particle Accelerators
Number of Classes	8	8	5

Details of the topic	Energy loss due to ionization (Bethe-Block formula), energy loss of electrons, Cerenkov radiation. Gamma ray interaction through matter, photoelectric effect, Compton scattering, pair production, neutron interaction with matter.	Gas detectors: estimation of electric field, mobility of particle, for ionization chamber and GM Counter. Basic principle of Scintillation Detectors and construction of photo-multiplier tube (PMT). Semiconductor Detectors (Si and Ge) for charge particle and photon detection (concept of charge carrier and mobility), neutron detector.	Accelerator facility available in India: Van-de Graaff generator (Tandem accelerator), Linear accelerator, Cyclotron, Synchrotrons
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.		
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz • Seminar Presentation/Group Discussion/Micro Teaching		
Paper Code/Title	**Paper Title: NANO MATERIALS AND APPLICATION** **Paper Code: PHYSICS DSE -4**		
Allotted Unit/Topic	I - Nanoscale systems		
Number of Classes	10		
Details of the topic	Length scales in Physics, Nanostructures: 1D, 2D and 3D nanostructures (nanodots, thin films, nanowires, nanorods), Band structure and density of states of materials at nanoscale, Size Effects in nano systems, Quantum confinement: Applications of Schrodinger equation- Infinite potential well, potential step, potential box, quantum confinement of carriers in 3D, 2D, 1D nanostructures and its consequences.		
Teaching Tools	• Board and Marker • ICT tools like Projector, online platform like zoom, Google Classroom etc.		
Evaluation Process	• Sessional Examination • Unit Test • Google Class Room Quiz Seminar Presentation/Group Discussion/Micro Teaching		

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Signature