গড়গাঁও মহাবিদ্যালয়

GARGAON COLLEGE

# TEACHING PLAN
# DEPARTMENT OF PHYSICS
# JULY 2023-JUNE 2024

# GARGAON COLLEGE
# TEACHING PLAN

Course: B. Sc.

Session: Odd semester 2023

**Subject:** Physics

**Name of the Teacher:** MR. DIGANTA KONWAR

**Designation**: Associate Professor

**Methods to be applied:** Lecture, Assignment and test, interaction and discussion.

**Teaching Materials:** Board and Marker, ICT tools like Projector, online platform like zoom, Google Classroom etc.

| Paper Code/ Title | Allotted Unit/ Topic | No. Of Class required | Detail of the topic to be taught | No. Of tutorials |
|---|---|---|---|---|
| **C-1: Mechanics and Properties of Matter** | **Unit 2:** Properties of Matter | 4 | Kinematics of Moving Fluids, Poiseuille's Equation for Flow of a Liquid through a Capillary Tube | 1 |
| | **Unit 3:** Oscillations | 8 | Simple Harmonic Motion (SHM) and Oscillations, Differential Equation of SHM and its solution, Kinetic Energy, Potential Energy, Total energy and their time-average values, Damped oscillation, Forced oscillations, Resonance, Power Dissipation and Quality Factor. | 2 |
| **Minor-1: Mechanics** | **Unit 3:** Oscillations | 10 | Simple Harmonic Motion (SHM) and Oscillations, Differential Equation of SHM and its solution, Kinetic Energy, Potential Energy, Total energy and their time-average values, Damped oscillation, Forced oscillations, Resonance, Power Dissipation and Quality Factor. | 2 |
| **SEC-1: Electrical Circuits and Network Skills** | **Unit 8:** ElectricalElectrical Wiring | 3 | Different types of conductors and cables. Basics of wiring-Star and delta connection. Voltage drop and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits. Insulation. Solid and stranded cable. Conduit. Cable trays. Splices: wire nuts, crimps, terminal blocks, split bolts, and solder. Preparation of the extension board. | |
| **C-7: Digital Electronics** | **i. Introduction to CRO:** | 3 | 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 | |
| | **ii. Integrated Circuits (Qualitative treatment only)** | 3 | 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. | 1 |
| | **iii. Digital** | 6 | Difference between Analog and Digital | 2 |

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| | **Circuits** | | 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. | |
| | **iv. Boolean algebra** | 6 | 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. | 1 |
| | **v. Data processing circuits** | 4 | Basic idea of Multiplexers, De-multiplexers, Decoders, Encoders | 1 |
| | **vi. Arithmetic Circuits** | 5 | Binary Addition. Binary Subtraction using 2's Complement. Half and Full Adders. Half & Full Subtractors, 4-bit binary Adder/Subtractor. | 1 |
| | **vii. Sequential Circuits** | 6 | 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. | 1 |
| | **viii. Timers** | 3 | IC 555: block diagram and applications: Astable multivibrator and Monostable multivibrator. | 1 |
| | **ix. Shift registers** | 2 | Serial-in-Serial-out, Serial-in-Parallel-out, Parallel-in-Serial-out and Parallel-in-Parallel-out Shift Registers (only up to 4 bits). | |
| **C-12: Solid State Physics** | **i. Dielectric Properties of Materials** | 8 | 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. | 2 |
| | **ii. Ferroelectric Properties of Materials:** | 6 | Structural phase transition, Classification of crystals, Piezoelectric effect, Pyroelectric effect, Ferroelectric effect, Electrostrictive effect, Curie-Weiss Law, Ferroelectric domains,PE hysteresis loop | 1 |
| | **iii. Elementary band theory** | 10 | 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 | 2 |
| **DSE-1: Classical Dynamics** | **i. Classical Mechanics of Point Particles** | 22 | 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- | 4 |

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| | | | 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. | |
| | **ii. Small Amplitude Oscillations** | 10 | 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. | 2 |
| **GE-3: Thermal Physics and Statistical Mechanics** | **iii. Kinetic Theory of Gases** | 10 | 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. | 1 |

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**Name of the Teacher:** MR. DIGANTA KONWAR

**Designation**: Associate Professor

**Methods to be applied:** Lecture, Assignment and test, interaction and discussion.

**Teaching Materials:** Board and Marker, ICT tools like Projector, online platform like zoom, Google Classroom etc.

| Paper Code/ Title | Allotted Unit/ Topic | No. Of Class required | Detail of the topic to be taught | No. Of tutorials |
|---|---|---|---|---|
| **C-2: Wave and optics** | **Unit 1:** Superposition of Harmonic Oscillations | 5 | 1. Linearity and Superposition Principle. Superposition of two collinear oscillations having equal frequencies and different frequencies (Beats). Superposition of N collinear Harmonic Oscillations with equal phase differences and equal frequency differences. | 1 |
| | | 3 | 2. Graphical and Analytical Methods. Lissajous Figures with equal and | |

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| | | | unequal frequency and their use. | |
| **Minor-2: Waves and Optics** | **Unit 1:** Superposition of Harmonic Oscillations | 8 | **1.1:** Linearity and Superposition Principle,<br>Superposition of two collinear oscillations having (i) equal frequencies and (ii) different frequencies(Beats), Superposition of N collinear Harmonic Oscillations with (i) equal phase differences and (2) equal frequency differences | 2 |
| | | 5 | **1.2:** Superposition of two perpendicular Harmonic Oscillations: Graphical and Analytical Methods, Lissajous Figures with equal and unequal frequency and their use. | 1 |
| **SEC-2: Basic Instrumentation Skills** | **Unit 3:** Cathode Ray Oscilloscope | 2 | Block diagram of basic CRO. Construction of CRT, Electron gun, electrostatic focusing and acceleration (Explanation only– no mathematical treatment), brief discussion on screen phosphor, visual persistence & chemical composition. Time base operation, synchronization. Front panel controls. Specifications of a CRO and their significance. | |
| **C-10: Analog system and Applications** | **i. Semiconductor Diodes** | 10 | 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. | 1 |
| | **ii. Two-terminal Devices and their Applications** | 6 | (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. | 1 |
| | **iii. Bipolar Junction transistors** | 6 | n-p-n and p-n-p Transistors. Characteristics of CB, CE and CC Configurations. Current gains $\alpha$ and $\beta$ Relations between $\alpha$ and $\beta$. Load Line analysis of Transistors. DC Load line and Q-point. Physical Mechanism of Current Flow. Active, Cutoff and Saturation Regions. | 1 |
| | **iv. Amplifiers** | 10 | Transistor Biasing and Stabilization Circuits. Fixed Bias and Voltage Divider Bias. Transistor as 2-port Network. h-parameter Equivalent Circuit. Analysis of | 2 |

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| | | | a single-stage CE amplifier using Hybrid Model. Input and Output Impedance. Current, Voltage and Power Gains. Classification of Class A, B & C Amplifiers. | |
| | **v. Coupled amplifiers** | 4 | Two stage RC coupled Amplifier and its frequency response. | |
| | **vi. Feedback in Amplifiers** | 4 | Effect of positive and negative feedback on Input impedence, Output impedence, Gain , Stability, Distortion and noise. | 1 |
| **DSE-3: Nuclear and Particle Physics** | **i. General Properties of Nuclei** | 10 | 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. | 2 |
| | **ii. Nuclear Models** | 12 | 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. | 3 |
| | **iii. Radioactivity decay** | 10 | (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. | 2 |
| | **iv. Nuclear Reactions** | 8 | 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). | 2 |

Diganta Konwar

HoD, Dept of Physics

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# GARGAON COLLEGE
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Course: B. Sc.

Session: Odd semester 2023

**Subject:** Physics

**Name of the Teacher:** GUNA KANTA SONOWAL

**Designation**: Assistant Professor

**Methods to be applied:** Lecture, Assignment and test, Seminar Presentation/Group Discussion/Micro Teaching.

**Teaching Materials:** Board and Marker, ICT tools like Projector, online platform like Google meet, zoom, Google Classroom etc.

| Paper Code/ Title | Allotted Unit/ Topic | No. Of Class required | Detail of the topic to be taught | No. Of tutorials |
|---|---|---|---|---|
| **C-1 : Mechanics and Properties of Matter** | **Unit 2:** Properties of Matter | **4** | Relation between Elastic constants, Twisting torque on a Cylinder or Wire. | **1** |
| | **Unit 4:** Non-Inertial Systems | **8** | 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. | **2** |
| **Minor-1 : Mechanics and Properties of Matter** | Properties of Matter | **4** | Relation between Elastic constants, Twisting torque on a Cylinder or Wire. | **1** |
| | Non-Inertial Systems | **8** | 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. | **2** |
| **SEC-1: Electrical circuit and networking.** | **Unit-1: Basic electricity Principle** | **2** | Voltage, Current, Resistance, and Power. Ohm's law. Series, parallel, and series-parallel combinations. AC Electricity and DC, Electricity. Familiarization with multimeter, voltmeter and ammeter. | |
| | **Unit 2:** Understandin g Electrical | **1** | Main electric circuit elements and their combination. Rules to analyze DC sourced electrical | |

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| | Circuits | | circuits. Current and voltage drop across the DC circuit elements. | |
| **C-6: Thermal Physics** | **i. Thermodynamic Potentials** | **7** | 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 . | **1** |
| | **ii. Maxwell's Thermodynamic Relations** | **7** | 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. | **1** |
| | **iii. Distribution of Velocities** | **7** | 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. | **2** |
| | **iv. Molecular Collisions** | **4** | 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. | **1** |
| | **v. Real Gases** | **10** | 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. | **3** |
| **GE-3: Thermal Physics and Statistical Mechanics** | **i. Statistical Mechanics:** | **12** | 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. | **3** |
| **C-11:** | **i.** Time | **6** | Time dependent Schrodinger equation and | |

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| **Quantum Mechanics and Applications.** | dependent Schrodinger equation | | 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. | |
| | **ii. Time independent Schrodinger equation** | **10** | Hamiltonian, stationary states and energy eigenvalues; expansion of an arbitrary wavefunction as a linear combination of energy eigenfunctions; General solution of the time dependent Schrodinger equation in terms of linear combinations of stationary states; Application to spread of Gaussian wave-packet for a free particle in one dimension; wave packets, Fourier transforms and momentum space wavefunction; Position-momentum uncertainty principle. | **3** |
| | **iii. General discussion of bound states in an arbitrary potential** | **12** | 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. | |
| | **iv. Quantum theory of hydrogen-like atoms** | **10** | 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. | **2** |
| | **v. Atoms in Electric & Magnetic Fields**: | **8** | 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. | **2** |
| | **vi. Atoms in External Magnetic Fields** | **4** | Normal and Anomalous Zeeman Effect. Paschen Back and Stark Effect (Qualitative Discussion only). | |
| | **vii. Many electron atoms**: | **10** | Pauli's Exclusion Principle. Symmetric & Antisymmetric Wave Functions. Periodic table. Fine structure. Spin orbit coupling. Spectral Notations for Atomic States. Total | **3** |

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| | | | 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.) | |

# GARGAON COLLEGE
# TEACHING PLAN

Course: B. Sc.

Session: Even semester 2024

**Subject:** Physics

**Name of the Teacher:** GUNA KANTA SONOWAL

**Designation**: Assistant Professor

**Methods to be applied:** Lecture, Assignment and test, Seminar Presentation/Group Discussion/Micro Teaching.

**Teaching Materials:** Board and Marker, ICT tools like Projector, online platform like Google meet, zoom, Google Classroom etc.

| Paper Code/ Title | Allotted Unit/ Topic | No. Of Class required | Detail of the topic to be taught | No. Of tutorials |
|---|---|---|---|---|
| **C-2: Waves and Optics** | **Unit 3:** Harmonic Waves | **7** | 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. | **1** |
| **Minor-2: Waves and Optics** | **Unit 3:** Superposition of Harmonic Waves | **7** | 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. | **1** |
| **SEC-2: Basic Instrumentation Skills** | **Unit 1:** Basic of Measurement | **2** | Instruments accuracy, precision, sensitivity, resolution range etc. Errors in measurements and loading effects. | |

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| | | | **Multimeter:** Principles of measurement of dc voltage<br>and dc current, ac voltage, ac current and resistance.<br>Specifications of a multimeter and their significance | |
| **C-8: Mathematical Physics- III** | **i.** Complex Analysis. | **30** | 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. | **4** |
| **GE-4: Wave and Optics** | **i. Sound** | **10** | 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. | **2** |
| **C-13: electromagnetic Theory** | **i. Polarization of Electromagnetic Waves** | **12** | 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 | |
| **C-14: Statistical Mechanics** | **i. Classical Statistics** | **18** | 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 | **3** |

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| | | | Equipartition of Energy (with proof) – Applications to Specific Heat and its Limitations, Thermodynamic Functions of a Two-Energy Levels System, Negative Temperature | |
| | **ii. Classical Theory of Radiation:** | **9** | 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. | **1** |
| | **iii. Quantum Theory of Radiation:** | **5** | 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. | |

(Guna Kanta Sonowal)

H.O.D.

Dept of Physics

HOD
Department of Physics
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# TEACHING PLAN FOR ODD SEMESTER

Course: B. Sc.

Session: Odd semester 2023

**Subject:** Physics

**Name of the Teacher:** JAYANTA SONOWAL

**Designation**: Assistant Professor

| **Semester** | **First Semester (Major)** |
|---|---|
| **Paper Code/Title** | **Paper Code: C - 1**<br>**Paper Title:** MECHANICS AND PROPERTIES OF MATTER |
| **Allotted Unit/Topic** | Newtonian Mechanics |
| **Number of Classes** | 12 |
| **Details of the topic** | 1.1: Frames of Reference, Inertial Frames, Galilean Transformations, Galilean Invariance; Dynamics of a System of Particles, Centre of Mass, Principle of Conservation of Linear Momentum.<br><br>1.2: The Work-Energy Theorem, Conservative and Non-conservative Forces, Conservation of Mechanical Energy, Work done by non-conservative forces, Force as gradient of potential energy, Energy Diagram, Stable and Unstable Equilibrium |
| **Teaching Tools** | • Board and Marker<br>• ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |
| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Seminar Presentation/Group Discussion |
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| **Semester** | **First Semester (Minor)** |
| **Paper Code/Title** | **Paper Code: MINOR 1**<br>**Paper Title: MECHANICS** |
| **Allotted Unit/Topic** | Newtonian Mechanics |
| **Number of Classes** | 6 |
| **Details of the topic** | 1.1: Frames of Reference, Inertial Frames, Galilean Transformations, Galilean Invariance; Dynamics of a System of Particles, Centre of Mass, Principle of Conservation of Linear Momentum. |
| **Teaching Tools** | • Board and Marker<br>• ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |

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| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Seminar Presentation/Group Discussion |
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| **Semester** | **First Semester (Generic Elective Courses)** |
| **Paper Code/Title** | **Paper Code: GEC - 1**<br>**Paper Title: Generic Elective Course** |

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| **Allotted Unit/Topic** | Unit: 2 |
| **Number of Classes** | 6 |
| **Details of the topic** | Maxwell's contributions, Contributions of Thomas A. Addison. |
| **Teaching Tools** | • Board and Marker<br>• ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |
| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Seminar Presentation/Group Discussion |
| | |
| **Semester** | **First Semester (Generic Elective Courses)** |
| **Paper Code/Title** | **Paper Code: GEC - 1**<br>**Paper Title: Generic Elective Course** |
| **Allotted Unit/Topic** | Generators |
| **Number of Classes** | **3** |
| **Details of the topic** | DC Power Sources, AC/ DC generators, Inductance, Capacitance and Impedance. Operation of transformers, Single phase, three phase & DC Motors. Basic design. Interfacing DC or AC Sources to control heater and motors, speed and power of ac motor. |
| **Teaching Tools** | • Board and Marker<br>ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |
| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>Seminar Presentation/Group Discussion |
| | |
| **Semester** | **Third Semester (Honours)** |
| **Paper Code/Title** | **Paper Code: PHYSICS-C III**<br>**Paper Title: MATHEMATICAL PHYSICS-II** |
| **Allotted Unit/Topic** | Theory of Errors, Partial Differential Equations |
| **Number of Classes** | 20 |
| **Details of the topic** | **Theory of Errors:**<br><br>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.<br><br>**Partial Differential Equations**:<br><br>Solutions to partial differential equations, using separation of variables: Laplace's Equation in problems of rectangular, cylindrical andspherical symmetry. Wave equation and its solution for vibrational modes of a stretched string, rectangular and circular membranes. Diffusion |

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| | Equation. |
| **Teaching Tools** | • Board and Marker<br>• ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |
| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Seminar Presentation/Group Discussion |
| | |
| **Semester** | **Third Semester (Honours)** |
| **Paper Code/Title** | **Paper Code: PHYSICS-C III**<br>**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**:<br><br>Input/ Output Devices. Data storage (idea of RAM and ROM). Computer memory. Memory organization & addressing. Memory Interfacing. Memory Map.<br><br>**Intel 8085 Microprocessor Architecture:**<br><br>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<br><br>**Introduction to Assembly Language:**<br>1 byte, 2 byte & 3 byte instruction |
| **Teaching Tools** | • Board and Marker<br>• ICT tools like Projector<br>• Online platform like Google Classroom, Google Meet etc. |
| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Seminar Presentation/Group Discussion |
| | |
| **Semester** | **Third Semester (Generic)** |
| **Paper Code/Title** | **Paper Code: GE-3**<br>**Paper Title: THERMAL PHYSICS AND STATISTICAL MECHANICS** |
| **Allotted Unit/Topic** | Thermodynamic Potentials |

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| **Number of Classes** | 10 |
| **Details of the topic** | **Thermodynamic Potentials:**<br>Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations and applications - Joule-Thompson Effect, Clausius-Clapeyron Equation, Expression for (CP – CV), CP/CV, TdS equations. |
| **Teaching Tools** | • Board and Marker<br>• ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |
| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Seminar Presentation/Group Discussion |
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| **Semester** | **Fifth Semester (Honours)** |
| **Paper Code/Title** | **Paper Code: PHYSICS-DSE 2**<br>**Paper Title: ASTRONOMY AND ASTROPHYSICS** |
| **Allotted Unit/Topic** | **Astronomical Scales:** Astronomical Scales, Basic concepts of positional astronomy, Astronomical techniques, Physical principles, The milky way, Large scale structure & expanding universe.<br><br>**Basic concepts of positional astronomy:**<br>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.<br><br>**Astronomical techniques**:<br>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).<br><br>**Physical principles:**<br><br>Gravitation in Astrophysics (Virial Theorem, Newton versus Einstein), |

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| | Systems in Thermodynamic Equilibrium.<br><br>**The milky way** :<br>Basic Structure and Properties of the Milky Way, Nature of Rotation of the Milky Way (Differential Rotation of the Galaxy and Oort Constant, Rotation Curve of the Galaxy and the Dark Matter, Nature of the Spiral Arms), Stars and Star Clusters of the Milky Way, Properties of and around the Galactic Nucleus. |
| **Number of Classes** | 47 |
| **Details of the topic** | |
| **Teaching Tools** | • Board and Marker<br>• ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |
| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Seminar Presentation/Group Discussion |

# TEACHING PLAN FOR EVEN SEMESTER

Course: B. Sc.

Session: Even semester 2024

**Subject:** Physics
**Name of the Teacher:** JAYANTA SONOWAL
**Designation**: Assistant Professor

| **Semester** | **Second Semester (Honours)** |
|---|---|
| **Paper Code/Title** | **Paper Code: C-2**<br>**Paper Title: Waves and Optics** |
| **Allotted Unit/Topic** | Interference |
| **Number of Classes** | 12 |
| **Details of the topic** | **5.1 :** 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. Newton's Rings: Measurement of wavelength and refractive index.<br>**5.2 :** Michelson Interferometer- (i) Idea of form of fringes (No theory required), (ii) Determination of Wavelength, (iii) Wavelength Difference, (iv) Refractive Index and (v) Visibility of Fringes. Fabry-Perot interferometer. |
| **Teaching Tools** | • Board and Marker<br>• ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |
| **Evaluation Process** | • Sessional Examination<br>• Unit Test |

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| | • Seminar Presentation/Group Discussion |
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| **Semester** | **Second Semester (Minor)** |
| **Paper Code/Title** | **Paper Code: Minor-2**<br>**Paper Title: Waves and Optics** |
| **Allotted Unit/Topic** | Interference |
| **Number of Classes** | 14 |
| **Details of the topic** | **5.1:** Division of amplitude and wavefront, Young's double slit experiment, Lloyd's Mirror and Fresnel's Bi-prism, Phase change on reflection: Stokes' treatment, Interference in Thin Films: parallel and wedge-shaped films. Newton's Rings: Measurement of wavelength and refractive index. |
| **Teaching Tools** | • Board and Marker<br>• ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |
| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Seminar Presentation/Group Discussion |
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| **Semester** | **Second Semester** |
| **Paper Code/Title** | **Paper Code: SEC-2**<br>**Paper Title: Basic Instrumentation Skills** |
| **Allotted Unit/Topic** | Digital Instruments, Digital Multimeter |
| **Number of Classes** | 4 |
| **Details of the topic** | Principle and working of digital meters. Comparison of analog and digital instruments. Characteristics of digital meter. Working principle of digital voltmeter.<br><br>Block diagram and working of a digital multimeter. Working principle of time interval, frequency and period measurement using universal counter/ frequency counter, time- base stability, accuracy and resolution. |
| **Teaching Tools** | • Board and Marker<br>ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |
| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Seminar Presentation/Group Discussion |
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| **Semester** | **Second Semester** |
| **Paper Code/Title** | **Paper Code: GEC-2**<br>**Paper Title: Generic Elective Course** |
| **Allotted Unit/Topic** | States of Matter |
| **Number of Classes** | 3 |

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| **Details of the topic** | States of Matter:<br>Overview of the different states of matter: Solid, Liquid, Gas and Plasma |
| **Teaching Tools** | • Board and Marker<br>• ICT tools like Projector<br>• online platform like Google Classroom, Google Meet etc. |
| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Seminar Presentation/Group Discussion |
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| **Semester** | **Forth Semester (Honours)** |
| **Paper Code/Title** | **Paper Code: PHYSICS-C-IX**<br>**Paper Title: ELEMENTS OF MODERN PHYSICS** |
| **Allotted Unit/Topic** | Nuclear size and Structure, Nuclear Reaction and Lasers. |
| **Number of Classes** | 17 |
| **Details of the topic** | **Nuclear size and structure:** 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.<br><br>**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.<br><br>**Nuclear Reaction:** Fission and fusion- mass deficit, relativity and generation of energy; Fission - nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting with Uranium 235; Fusion and thermonuclear reactions driving stellar energy (brief qualitative discussions).<br><br>**Lasers:** Einstein's A and B coefficients. Metastable states. Spontaneous and Stimulated emissions. Optical Pumping and Population Inversion. Three-Level and Four-Level Lasers. Ruby Laser and He-Ne Laser. Basic lasing. |
| **Teaching Tools** | • Board and Marker<br>• ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |
| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Seminar Presentation/Group Discussion |
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| Semester | Fourth Semester (Generic) |
|---|---|
| Paper Code/Title | Paper Code: GE-4<br>Paper Title: WAVES AND OPTICS |
| Allotted Unit/Topic | Wave and Optics, Interference |
| Number of Classes | 14 |
| Details of the topic | **Wave Optics:** Electromagnetic nature of light. Definition and Properties of wave front. Huygens Principle.<br><br>**Interference:**<br>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<br>• ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |
| Evaluation Process | • Sessional Examination<br>• Unit Test<br>• Seminar Presentation/Group Discussion |

| Semester | Sixth Semester (Honours) |
|---|---|
| Paper Code/Title | Paper Code: PHYSICS-DSE-4<br>Paper Title: NANO MATERIALS AND APPLICATIONS |
| Allotted Unit/Topic | Synthesis of nanostructure materials, Characterization, Optical properties, Electron transport, Applications. |
| Number of Classes | 50 |
| Details of the topic | **Synthesis of nanostructure materials:**<br>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<br>**Characterization:**<br>X- ray diffraction, Optical Microscopy, Scanning electron Microscopy , Transmission Electron Microscopy , Atomic Force Microscopy, Scanning Tunneling Microscopy.<br><br>**Optical properties:**<br>Coulomb interaction in nanostructures. Concept of dielectric constant for nanostructures and charging of nanostructure. Quasi-particles and excitons. |

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| | 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.<br><br>**Electron transport:**<br>Carrier transport in nanostrcutures. Coulomb blockade effect, thermionic emission, tunneling and hoping conductivity. Defects and impurities: Deep level and surface defects.<br><br>**Applications:**<br>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<br>• ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |
| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Seminar Presentation/Group Discussion |

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Gargaon College

**SIGNATURE**

**HOD Physics**
**Gargaon College**

**SIGNATURE**

**Jayanta Sonowal**
**Dept of Physics**

# GARGAON COLLEGE
# TEACHING PLAN
Course: B. Sc.
Session: Odd semester 2023

**Subject:** PHYSICS
**Name of the Teacher:** DR. GITASHRI ARANDHARA
**Methods to be applied:** Lecture, analytical and activity method, interaction and discussion.
**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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|---|---|---|
| **Semester** | **First Semester (Major) FYUGP** | |
| **Paper Code/Title** | **Paper Title: Mechanics and Properties of Matter**<br>**Paper Code: C 1** | |
| **Allotted Unit/Topic** | **Unit 1**: **Newtonian Mechanics** | |
| **Number of Classes** | **12** | |
| **Details of the topic** | 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. | |
| **Semester** | **First Semester (Minor) FYUGP** | |
| **Paper Code/Title** | **Paper Title: Mechanics**<br>**Paper Code: Minor 1** | |
| **Allotted Unit/Topic** | **Unit 1: Newtonian Mechanics** | |
| **Number of Classes** | **10** | |
| **Details of the topic** | 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. | |
| **Semester** | **First Semester FYUGP** | |
| **Paper Code/Title** | **Paper Title: Electrical circuits and Network Skills**<br>**Paper Code: SEC 1** | |
| **Allotted Unit/Topic** | **Unit 2: Understanding Electrical Circuit**<br>**Unit 3: Electrical Drawing and Symbols**<br>**Demonstration and Laboratory** | |
| **Number of Classes** | **5** | **5** |
| **Details of the topic** | Unit2: Single-phase and three-phase alternating current sources. Rules to analyze AC sourced electrical circuits. Real, imaginary and complex power components of AC source. Power factor. Saving energy and money. | Unit3: Drawing symbols. Blueprints. Reading Schematics. Ladder diagrams. Electrical Schematics. Power circuits. Control circuits. Reading of circuit schematics. Tracking the connections of elements and identifying current flow and voltage drop. |

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| **Semester** | **First Semester FYUGP** | |
| **Paper Code/Title** | **Paper Title: Evolution of Science**<br>**Paper Code: GEC 1** | |
| **Allotted Unit/Topic** | **Unit 1** | **Unit 3** |
| **Number of Classes** | **7** | **8** |
| **Details of the topic** | Contributions of Aristotle, Galileo Galilei, Robert Hooke, Darwin Kepler etc.Contributions of Sir Isaac Newton: Laws of motion,Universal law of Gravitation | Nuclear era: space science and technology.Electronic age and birth of computers. Laser and optical evolution. Contemporary science and India's contribution. |
| **Semester** | **Third Semester (Honours)** | |
| **Paper Code/Title** | **Paper Title: T H E R M A L P H Y S I C S (THEORY)**<br>**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. |
| **Semester** | **Third Semester (Generic)** | |
| **Paper Code/Title** | **Paper Title: Thermal Physics and Statistical Mechanics**<br>**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. | |
| **Semester** | **Fifth Semester (Honours)** | |
| **Paper Code/Title** | **Paper Title: SOLID STATE PHYSICS (THEORY)**<br>**Paper Code: PHYSICS-C-XII** | |
| **Allotted Unit/Topic** | **Crystal Structure** | |

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| **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) |

# GARGAON COLLEGE
# TEACHING PLAN
Course: B. Sc.
Session: Even semester 2024

**Subject:** PHYSICS
**Name of the Teacher:** DR. GITASHRI ARANDHARA
**Methods to be applied:** Lecture, analytical and activity method, interaction and discussion.
**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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| **Semester** | **Second Semester (Honours)** | |
| **Paper Code/Title** | **Paper Title: Waves and Optics**<br>**Paper Code: C-2** | |
| **Allotted Unit/Topic** | **Unit 2: Wave Motion** | |
| **Number of Classes** | **6** | **5** |
| **Details of the topic** | **2.1:** Plane and Spherical Waves, Longitudinal and Transverse Waves, Plane Progressive (Travelling) Waves, Wave Equation, Particle and Wave Velocities, Differential Equation of a Wave, Pressure of a Longitudinal Wave, Energy Transport, Intensity of Wave. | **2.2:** 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. |
| **Allotted Unit/Topic** | **Unit 4: Wave optics** | |
| **Number of Classes** | **3** | |
| **Details of the topic** | Electromagnetic nature of light, definition and properties of wave front, Huygens principle, Temporal and Spatial coherence. | |
| **Semester** | **Second Semester (Minor) FYUGP** | |
| **Paper Code/Title** | **Paper Title: Waves and Optics**<br>**Paper Code: Minor 2** | |
| **Allotted Unit/Topic** | **Unit 2: Wave Motion** | |
| **Number of Classes** | **4** | **5** |
| **Details of the topic** | **2.1:** Plane and Spherical Waves, Longitudinal and Transverse Waves, Plane Progressive (Travelling) Waves, Wave Equation, Particle and Wave Velocities, Differential Equation of a Wave, Pressure of a Longitudinal Wave, Energy Transport, Intensity of Wave. | **2.2:** 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. |

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| **Paper Code/Title** | **Paper Title: Materials Today**<br>**Paper Code: GEC 2** | |
| **Allotted Unit/Topic** | **Unit IV: Trends in Advanced Materials** | |
| **Number of Classes** | **15** | |
| **Details of the topic** | Breakthroughs in Materials Development Overview of Advanced Materials: Semiconductors, Biomaterials, Smart Materials (Materials of the Future), Nano-structured Materials | |
| **Semester** | **Fourth Semester (Honours)** | |
| **Paper Code/Title** | **Paper Title: ELEMENTS OF MODERN PHYSICS (THEORY)**<br>**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-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 | Position measurement- gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle (Uncertainty relations 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. |
| **Semester** | **Fourth Semester (Generic)** | |
| **Paper Code/Title** | **Paper Title: W A V E S A N D O P T I C S (THEORY)**<br>**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. |

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| **Semester** | **Sixth Semester (Honours)** |
| **Paper Code/Title** | **Paper Title: ELECTROMAGNETIC THEORY**<br>**Paper Code: PHYSICS-C-XIII** |

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| **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. | | |
| **Paper Code/Title** | **Paper Title: NUCLEAR AND PARTICLE PHYSICS (THEORY)**<br>**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 |
| **Paper Code/Title** | **Paper Title: NANO MATERIALS AND APPLICATION**<br>**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. | | |

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Gargaon College

Gitashri Barudkara
Signature

# TEACHING PLAN FOR ODD SEMESTER

Course: B. Sc.

Session: Odd semester 2023

**Subject:** Physics

**Name of the Teacher:** DR. BIDYUT BIKASH HAZARIKA

**Designation**: Assistant Professor

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| **Semester** | **First Semester (Major)** |
| **Paper Code/Title** | **Paper Code: C - 1**<br>**Paper Title:** MECHANICS AND PROPERTIES OF MATTER |
| **Allotted Unit/Topic** | Special Theory of Relativity |
| **Number of Classes** | 16 |
| **Details of the topic** | Michelson-Morley Experiment and its outcome, Postulates of Special Theory of Relativity, Lorentz Transformations, Simultaneity and order of events, Lorentz contraction, Time dilation. Relativistic Transformation of Velocity, Frequency and Wave-number, Relativistic addition of Velocities, Variation of Mass with Velocity, Massless Particles, Mass-energy Equivalence. Relativistic Kinematics, Transformation of Energy and Momentum, Relativistic Doppler effect. |
| **Teaching Tools** | • Board and Marker<br>• ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |
| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Google Class Room Quiz<br>• Seminar Presentation/Group Discussion |
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| **Semester** | **First Semester (Minor)** |
| **Paper Code/Title** | **Paper Code: MINOR 1**<br>**Paper Title: MECHANICS** |
| **Allotted Unit/Topic** | Special Theory of Relativity |
| **Number of Classes** | 15 |
| **Details of the topic** | Michelson-Morley Experiment and its outcome, Postulates of Special Theory of Relativity, Lorentz Transformations, Simultaneity and order of events, Lorentz contraction, Time dilation. Relativistic addition of Velocities, Variation of Mass with Velocity, Mass-energy Equivalence. |
| **Teaching Tools** | • Board and Marker<br>• ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |

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| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Google Class Room Quiz<br>• Seminar Presentation/Group Discussion |
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| **Semester** | **First Semester** (Generic Elective Courses) |
| **Paper Code/Title** | **Paper Code:** GEC - 1 |

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|---|---|
| | **Paper Title:** Generic Elective Course |
| **Allotted Unit/Topic** | Unit: 2 |
| **Number of Classes** | 6 |
| **Details of the topic** | Nineteenth century and beginning of modern science: Developments of electricity and magnetism |
| **Teaching Tools** | • Board and Marker<br>• ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |
| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Google Class Room Quiz<br>• Seminar Presentation/Group Discussion |
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| **Semester** | **First Semester** (Skill Enhancement Course) |
| **Paper Code/Title** | SEC - 1 |
| **Allotted Unit/Topic** | Solid State Devices, Electrical Protections |
| **Number of Classes** | 3 |
| **Details of the topic** | Resistors, inductors and capacitors, Diode and rectifiers, Components in series or in shunt, Response of Inductors and capacitors with AC or DC sources.<br>Relays, fuses and disconnect switches, Circuit breakers, Overload devices. Ground-fault protection. Grounding and isolating. Phase reversal. Surge protection. Interfacing DC or AC sources to control elements (relay protection device) |
| **Teaching Tools** | • Board and Marker<br>• ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |
| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Google Class Room Quiz<br>• Seminar Presentation/Group Discussion |
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| **Semester** | **Third Semester (Honours)** |
| **Paper Code/Title** | **Paper Code: PHYSICS-C III**<br>**Paper Title: MATHEMATICAL PHYSICS-II** |
| **Allotted Unit/Topic** | Fourier Series, Frobenius Method and Special Functions, Some Special Integrals |
| **Number of Classes** | 38 |

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| **Details of the topic** | **Fourier Series**: Periodic functions. Orthogonality of sine and cosine functions, Dirichlet Conditions (Statement only). Expansion of periodic functions in a series of sine and cosine functions and determination of Fourier coefficients. Complex representation of Fourier series. Expansion of functions with arbitrary period. Expansion of non-periodic functions over an interval. Even and odd functions and their Fourier expansions. Application. Summing of Infinite Series. Term-by-Term differentiation and integration of Fourier Series. Parseval Identity.<br>**Frobenius Method and Special Functions**: Singular Points of Second Order Linear Differential Equations and their importance. Frobenius method and its applications to differential equations. Legendre, Bessel, Hermite and Laguerre Differential Equations. Properties of Legendre Polynomials: Rodrigues Formula, Generating Function, Orthogonality. Simple recurrence relations. Expansion of function in a series of Legendre Polynomials. Bessel Functions of the First Kind: Generating Function, simple recurrence relations. Zeros of Bessel Functions (Jo(x) and J1(x)) and Orthogonality.<br>**Some Special Integrals**: Beta and Gamma Functions and Relation between them. Expression of Integrals in terms of Gamma Functions. Error Function (Probability Integral). |
| **Teaching Tools** | • Board and Marker<br>• ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |
| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Google Class Room Quiz<br>• Seminar Presentation/Group Discussion |
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| **Semester** | **Third Semester (Generic)** |
| **Paper Code/Title** | **Paper Code: GE-3**<br>**Paper Title: THERMAL PHYSICS AND STATISTICAL MECHANICS** |
| **Allotted Unit/Topic** | Thermodynamic Description of system |
| **Number of Classes** | 22 |
| **Details of the topic** | **Thermodynamic Description of system**: Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between CP and CV, Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Coefficient, Reversible and irreversible processes, Second law and Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero. |
| **Teaching Tools** | • Board and Marker<br>• ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |

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| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Google Class Room Quiz<br>• Seminar Presentation/Group Discussion |
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| **Semester** | **Fifth Semester (Honours)** |
| **Paper Code/Title** | **Paper Code: PHYSICS-DSE I**<br>**Paper Title: CLASSICAL DYNAMICS** |
| **Allotted Unit/Topic** | Special Theory of Relativity, Fluid Dynamics |
| **Number of Classes** | 43 |
| **Details of the topic** | **Special Theory of Relativity**: Postulates of Special Theory of Relativity. Lorentz Transformations. Minkowski space. The invariant interval, light cone and world lines. Space-time diagrams. Time -dilation, length contraction and twin paradox. Four-vectors: space-like, time-like and light-like. Four-velocity and acceleration. Metric and alternating tensors. Four-momentum and energy-momentum relation. Doppler effect from a four-vector perspective. Concept of four-force. Conservation of four-momentum. Relativistic kinematics. Application to two-body decay of an unstable particle.<br>**Fluid Dynamics**: Density ρ and pressure P in a fluid, an element of fluid and its velocity, continuity equation and mass conservation, stream-lined motion, laminar flow, Poiseuille's equation for flow of a liquid through a pipe, Navier-Stokes equation, qualitative description of turbulence, Reynolds number. |
| **Teaching Tools** | • Board and Marker<br>• ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |
| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Google Class Room Quiz<br>• Seminar Presentation/Group Discussion |

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| **Semester** | **Fifth Semester (Honours)** |
| **Paper Code/Title** | **Paper Code: PHYSICS-DSE II**<br>**Paper Title: ASTRONOMY AND ASTROPHYSICS** |
| **Allotted Unit/Topic** | The Sun, Stellar spectra and classification Structure |
| **Number of Classes** | 26 |
| **Details of the topic** | **The sun** (Solar Parameters, Solar Photosphere, Solar Atmosphere, Chromosphere. Corona, Solar Activity, Basics of Solar Magneto-hydrodynamics. Helioseismology). The solar family (Solar System: Facts and Figures, Origin of the Solar System: The Nebular Model, Tidal Forces and Planetary Rings, ExtraSolar Planets. |

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| | Stellar spectra and classification Structure (Atomic Spectra Revisited, Stellar Spectra, Spectral Types and Their Temperature Dependence, Black Body Approximation, H R Diagram, Luminosity Classification)<br>**Stellar spectra and classification Structure** (Atomic Spectra Revisited, Stellar Spectra, Spectral Types and Their Temperature Dependence, Black Body Approximation, H R Diagram, Luminosity Classification) |
| **Teaching Tools** | • Board and Marker<br>• ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |
| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Google Class Room Quiz<br>• Seminar Presentation/Group Discussion |

# TEACHING PLAN FOR EVEN SEMESTER

Course: B. Sc.

Session: Even semester 2024

**Subject:** Physics
**Name of the Teacher:** DR. BIDYUT BIKASH HAZARIKA
**Designation**: Assistant Professor

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| **Semester** | **Second Semester (Major)** |
| **Paper Code/Title** | **Paper Code: C** - 2<br>**Paper Title: WAVES AND OPTICS** |
| **Allotted Unit/Topic** | Diffraction |
| **Number of Classes** | 15 |
| **Details of the topic** | **6.1 :** Kirchhoff's Integral Theorem, Fresnel-Kirchhoff's Integral formula (Qualitative discussion only)<br>**6.2 :** Fraunhofer Diffraction: Single slit, Circular aperture. Resolving Power of a telescope, Double slit, Multiple slits. Diffraction grating, Resolving power of grating.<br>**6.3 :** Fresnel Diffraction: Fresnel's Assumptions. Fresnel's Half-Period Zones for Plane Wave. Explanation of Rectilinear Propagation of Light. Theory of a Zone Plate: Multiple Foci of a Zone Plate. Fresnel's Integral, Fresnel diffraction pattern of a straight edge, a slit and a wire. |
| **Teaching Tools** | • Board and Marker<br>• ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |

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| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Google Class Room Quiz<br>• Seminar Presentation/Group Discussion |
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| **Semester** | **Second Semester (Minor)** |

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| **Paper Code/Title** | **Paper Code: Minor 2**<br>**Paper Title: WAVES AND OPTICS** |
| **Allotted Unit/Topic** | Wave Optics, Interference |
| **Number of Classes** | 14 |
| **Details of the topic** | Electromagnetic nature of light, definition and properties of wave front, Huygens principle, Temporal and Spatial coherence<br>**5.2:** Michelson Interferometer- (i) Idea of form of fringes (No theory required), (ii) Determination of Wavelength, (iii) Wavelength Difference, (iv) Refractive Index and (v) Visibility of Fringes. Fabry-Perot interferometer. |
| **Teaching Tools** | • Board and Marker<br>• ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |
| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Google Class Room Quiz<br>• Seminar Presentation/Group Discussion |
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| **Semester** | **Second Semester** (Generic Elective Course) |
| **Paper Code/Title** | **Paper Code: GEC-2**<br>**Paper Title:** MATERIALS TODAY |
| **Allotted Unit/Topic** | Classification of Engineering Materials |
| **Number of Classes** | 13 |
| **Details of the topic** | Metals & Alloys, Non-Metals, Ceramics, Polymers, Composites etc. with examples and applications Uses, Performance, Composition & Structure; Physical and Chemical properties; Processing & Synthesis of various classes of materials |
| **Teaching Tools** | • Board and Marker<br>• ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |
| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Google Class Room Quiz<br>• Seminar Presentation/Group Discussion |
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| **Semester** | **Forth Semester (Honours)** |
| **Paper Code/Title** | **Paper Code: PHYSICS-C VIII**<br>**Paper Title: MATHEMATICAL PHYSICS-III** |
| **Allotted Unit/Topic** | Integrals Transforms, Laplace Transforms |
| **Number of Classes** | 30 |
| **Details of the topic** | **Integrals Transforms**: Fourier Transforms: Fourier Integral theorem. Fourier Transform. Examples. Fourier transform of trigonometric, Gaussian, finite wave train & other functions. Representation of Dirac delta function as a |

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| | Fourier Integral. Fourier transform of derivatives, Inverse Fourier transform, Convolution theorem. Properties of Fourier transforms (translation, change of scale, complex conjugation, etc.). Three dimensional Fourier transforms with examples. Application of Fourier Transforms to differential equations: One dimensional Wave and Diffusion/Heat Flow Equations.<br>**Laplace Transforms**: Laplace Transform (LT) of Elementary functions. Properties of LTs: Change of Scale Theorem, Shifting Theorem. LTs of 1st and 2nd order Derivatives and Integrals of Functions, Derivatives and Integrals of LTs. LT of Unit Step function, Dirac Delta function, Periodic Functions. Convolution Theorem. Inverse LT. Application of Laplace Transforms to 2nd order Differential Equations: Damped Harmonic Oscillator, Simple Electrical Circuits, Coupled differential equations of 1st order. Solution of heat flow along infinite bar using Laplace transform. |
| **Teaching Tools** | • Board and Marker<br>• ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |
| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Google Class Room Quiz<br>• Seminar Presentation/Group Discussion |
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| **Semester** | **Fourth Semester (Generic)** |
| **Paper Code/Title** | **Paper Code: GE-4**<br>**Paper Title: WAVES AND OPTICS** |
| **Allotted Unit/Topic** | Diffraction |
| **Number of Classes** | 14 |
| **Details of the topic** | **Diffraction**: Fraunhofer diffraction- Single slit; Double Slit. Multiple slits and Diffraction grating. Fresnel Diffraction: Half-period zones. Zone plate. Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis. |
| **Teaching Tools** | • Board and Marker<br>• ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |
| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Google Class Room Quiz<br>• Seminar Presentation/Group Discussion |

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| **Semester** | **Sixth Semester (Honours)** |
| **Paper Code/Title** | **Paper Code: PHYSICS-C XIII**<br>**Paper Title: ELECTROMAGNETIC THEORY** |
| **Allotted Unit/Topic** | EM Wave Propagation in Unbounded Media, EM Wave in Bounded Media, Wave Guides |

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| **Number of Classes** | 28 |
| **Details of the topic** | **EM Wave Propagation in Unbounded Media**: Plane EM waves through vacuum and isotropic dielectric medium, transverse nature of plane EM waves, refractive index and dielectric constant, wave impedance. Propagation through conducting media, relaxation time, skin depth. Wave propagation through dilute plasma, electrical conductivity of ionized gases, plasma frequency, refractive index, skin depth, application to propagation through ionosphere.<br>**EM Wave in Bounded Media**: Boundary conditions at a plane interface between two media. Reflection & Refraction of plane waves at plane interface between two dielectric media-Laws of Reflection & Refraction. Fresnel's Formulae for perpendicular & parallel polarization cases, Brewster's law. Reflection & Transmission coefficients. Total internal reflection, evanescent waves. Metallic reflection (normal Incidence)<br>**Wave Guides**: Planar optical wave guides. Planar dielectric wave guide. Condition of continuity at interface. Phase shift on total reflection. Eigenvalue equations. Phase and group velocity of guided waves , Field energy and power transmission. |
| **Teaching Tools** | • Board and Marker<br>• ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |
| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Google Class Room Quiz<br>• Seminar Presentation/Group Discussion |
| **Semester** | **Sixth Semester (Honours)** |
| **Paper Code/Title** | **Paper Code: PHYSICS-C XIV**<br>**Paper Title: STATISTICAL MECHANICS** |
| **Allotted Unit/Topic** | Bose-Einstein Statistics, Fermi-Dirac Statistics |
| **Number of Classes** | 28 |
| **Details of the topic** | **Bose-Einstein Statistics**: B-E distribution law, Thermodynamic functions of a strongly Degenerate Bose Gas, Bose Einstein condensation, properties of liquid He (qualitative description), Radiation as a photon gas and Thermodynamic functions of photon gas. Bose derivation of Planck's law.<br>**Fermi-Dirac Statistics**: Fermi-Dirac Distribution Law, Thermodynamic functions of a Completely and strongly Degenerate Fermi Gas, Fermi Energy, Electron gas in a Metal, Specific Heat of Metals, Relativistic Fermi gas, White Dwarf Stars, Chandrasekhar Mass Limi |
| **Teaching Tools** | • Board and Marker<br>• ICT tools like Projector, online platform like Google Classroom, Google Meet etc. |

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| **Evaluation Process** | • Sessional Examination<br>• Unit Test<br>• Google Class Room Quiz<br>• Seminar Presentation/Group Discussion |

HOD
Department of Physics
Gargaon College

**SIGNATURE**
**Dr. Bidyut Bikash Hazarika**
**Dept of Physics**

**HOD Physics**