NEP FYUGP Physics Syllabus Distribution: Department of Physics: Salbari College, Salbari
Paper: All Major papers of 1st and 3rd semester

TEACHER	SEMESTER I	SEMESTER III	LECTURES
PD1 (Dr. Priyanka Das)	**28** **Mechanics** **Unit I: Fundamentals of Dynamics: (6 Lectures)** 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 and Laboratory frames, Principle of conservation of momentum. **Work and Energy: (3 Lectures)** 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. Law of conservation of Energy. **Rotational Dynamics: (7 Lectures)** Angular momentum of a particle 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. **Unit II: Gravitation and Central Force Motion: (3 Lectures)** 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: (3 Lectures)** Kepler's Laws. Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS).	**26** **Paper Title: Electricity and Magnetism** **UNIT II** **Magnetic Field: (8 Lectures)** Magnetic force between current elements and definition of magnetic field. 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. **Magnetic Properties of Matter**: **(3 Lectures)** Magnetization vector (M). Magnetic Intensity (H). Magnetic Susceptibility and permeability. Relation between B, H, M. Ferromagnetism. B-H curve and hysteresis. **Unit III:** **Electromagnetic Induction: (4 Lectures)** 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. **Electrical Circuits: (4 Lectures)** AC Circuits: Kirchhoff's laws for AC circuits. Complex Reactance and Impedance. Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and (4) Band Width. Parallel LCR Circuit. **Network theorems: (4 Lectures)** Ideal Constant-voltage and Constant-current Sources. Network Theorems: Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity	**67**

	Oscillations: (6 Lectures) 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.	theorem, Maximum Power Transfer theorem. Applications to dc circuits. **Ballistic Galvanometer: (3 Lectures)** Torque on a current Loop. Ballistic Galvanometer: Current and Charge Sensitivity. Electromagnetic damping. Logarithmic damping. CDR. **13** **Paper Title: Waves and Optics** **Unit I:** **Superposition of Collinear Harmonic oscillations: (4 Lectures)** 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: (2 Lectures)** Graphical and Analytical Methods. Lissajous Figures with equal an unequal frequency and their uses. **Wave Motion: (3 Lectures)** 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. **Velocity of Waves: (4 Lectures)** 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.	
PD2 (Dr. Pritam Das)	**17** **Mechanics** **Unit II:** **Elasticity: (2 Lectures)** Relation between Elastic constants. Twisting torque on a Cylinder or Wire. **Fluid Motion: (2 Lectures)** Kinematics of Moving Fluids: Poiseuille's Equation for Flow of a	**19** **Paper Title: Electricity and Magnetism** **Unit I: (3 Lectures)** Electric field: Electric field lines. Electric flux. Gauss' Law with applications to charge distributions with spherical, cylindrical and planar symmetry.	**68**

	Liquid through a Capillary Tube. **Motion of a particle under a central force field: (2 Lectures)** Two-body problem and its reduction to one-body problem and its solution. The energy equation and energy diagram. **Unit III:** **Non-Inertial Systems: (4 Lectures)** 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. **Special Theory of Relativity: (7 Lectures)** 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.	**Conservative nature of Electrostatic Field: (4 Lectures)** 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: (6 Lectures)** 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. **Unit II** **Dielectric Properties of Matter: (6 Lectures)** 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. **32** **Paper Title: Waves and Optics** **UNIT I** **Superposition of Two Harmonic Waves: (6 Lectures)** 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. **Unit II** **Wave Optics: (2 Lectures)** Electromagnetic nature of light. Definition and properties of wave front. Huygens Principle. Temporal and Spatial Coherence. **Interference: (7 Lectures)** 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); Fringees of equal thickness (Fizeau Fringes). Newton's Rings: Measurement of wavelength and refractive index. **Interferometer: (3 Lectures)** 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: (2 Lectures)** Kirchhoff's Integral Theorem, Fresnel-Kirchhoff's Integral formula. (Qualitative discussion only). **Unit III** **Fraunhofer diffraction: (5 Lectures)** Single slit. Circular aperture, Resolving Power of a telescope. Double slit. Multiple slits. Diffraction grating. Resolving power of grating. **Fresnel Diffraction: (7 Lectures)** 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.	
TOTAL	**45**	**45+45=90**	**135**

NEP FYUGP Physics Syllabus Distribution: Department of Physics: Salbari College, Salbari
Paper: All Minor papers of 1st and 3rd semester

TEACHER	SEMESTER I	SEMESTER III	LECTURES
PD1 (Dr. Priyanka Das)	**25** **Paper title: Mechanics** **Unit I: Laws of Motion: (4 Lectures)** Frames of reference. Newton's Laws of motion. Dynamics of a system of particles. Centre of Mass. **Momentum and Energy: (4 Lectures)** Conservation of momentum. Work and energy. Conservation of energy. Motion of rockets. **Unit II: Rotational Motion: (3 Lectures)** Angular velocity and angular momentum, Torque. Conservation of angular momentum. **Gravitation: (8 Lectures)** 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. Weightlessness. Basic idea of global positioning system (GPS). **Unit III: Oscillations: (6 Lectures)** Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations.	**23** **Paper Title: Thermal Physics and Statistical Mechanics** **UNIT I: Thermodynamic Description of system: (15 Lectures)** 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 & CV, Work Done during Isothermal and Adiabatic Processes, Compressibility & Expansion Coefficient, Reversible & irreversible processes, Second law & Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero. **Unit II:** **Thermodynamic Potentials: (8 Lectures)** Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations & applications - Joule-Thompson Effect, Clausius- Clapeyron Equation, Expression for (C_P–C_V), C_P/C_V, TdS equations.	**48**
PD2 (Dr. Pritam Das)	**20** **Paper: Mechanics** **Unit I:** **Vectors: (4 Lectures)** Vector algebra. Scalar and vector products. Derivatives of a vector with respect to a parameter. **Ordinary Differential Equations: (4 Lectures)** 1st order homogeneous differential equations. 2nd order homogeneous differential equations with constant coefficients.	**22** **Paper Title: Thermal Physics and Statistical Mechanics** **Unit II:** **Kinetic Theory of Gases: (8 Lectures)** 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 gasses; mono-atomic and diatomic gasses.	**42**

	Unit III: **Elasticity: (7 Lectures)** Hooke's law - Stress-strain diagram - Elastic moduli-Relation between elastic constants-Poisson's Ratio- Expression for Poisson's ratio in terms of elastic constants- Work done in stretching and work done in twisting a wire Twisting couple on a cylinder-Determination of Rigidity modulus by static torsion - Torsional pendulum- Determination of Rigidity modulus and moment of inertia by Searles method. **Special Theory of Relativity: (5 Lectures)** Constancy of speed of light. Postulates of Special Theory of Relativity. Length contraction. Time dilation. Relativistic addition of velocities.	**UNIT III:** **Theory of Radiation: (5 Lectures)** 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. **Statistical Mechanics: (9 Lectures)** 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.	
TOTAL	**45**	**45**	**90**

NEP FYUGP Physics Syllabus Distribution: Department of Physics: Salbari College, Salbari
Paper: All SEC papers of 1st and 3rd semester

TEACHER	SEMESTER I	SEMESTER III	LECTURES
PD1 (Dr. Priyanka Das)	**13** **Paper title: Instrumentation Skills in Physics-I** **Unit II: Signal Generators and Analysis Instruments: (8 Lectures)** Block diagram, explanation and specifications of low frequency signal generators. Pulse generator, and function generator. Brief idea for testing, specifications. Distortion factor meter, wave analysis. Impedance Bridges & Q-Meters: Block diagram of bridge. Working principles of basic RLC bridge. Specifications of RLC bridge. Block diagram & working principles of a Q- Meter. Digital LCR bridges. **Sensors and Transducers: (5 Lectures)** Principles of sensor operation, Types of sensors (temperature, pressure, strain, etc.), Selection and calibration of sensors, Sensor interfacing and signal conversion.	**15** **Paper Title: Electrical Network and Loads** **UNIT I: Introduction to electrical network: (10 Lectures)** Introduction to electrical Power, Ohm's law. Passive and active components in electrical networks. AC and DC electricity. Understanding electrical circuits: Kirchhoff's laws and circuit analysis techniques, Series, parallel, and series-parallel combinations. Applications of series and parallel circuits in practical systems. Rules to analyze DC sourced electrical circuits. Current and voltage drop across the DC circuit elements. Single-phase and three-phase alternating current sources. Three-phase power generation and transmission, Advantages and applications of three-phase systems. **Network Theorems: (5 Lectures)** Thevenin's theorem and Norton's theorem, Superposition theorem and maximum power transfer theorem, Application of network theorems in circuit simplification and analysis, Theoretical and practical limitations of network theorems.	**28**
PD2 (Dr. Pritam Das)	**17** **Paper title: Instrumentation Skills in Physics-I** **Unit I:** **Introduction to Instrumentation and Measurement: (3 Lectures)** Importance of instrumentation in physics research, Overview of different measurement techniques, units, standards, instruments accuracy, precision, sensitivity, and resolution range. **Electrical Measurements: (6 Lectures)** Basic components and circuit, voltage, current, and resistance measurements, colour code of resistance, Multimeters: Specifications of a multimeter and their significance. Analogue and Digital,	**15** **Paper Title: Electrical Network and Loads** **Unit II:** **Power, Energy and Loads: (10 Lectures)** Active, reactive, and apparent power, Power factor and its significance, Energy consumption and efficiency calculations, Power measurement techniques and instruments. Types of electrical loads: resistive, inductive, capacitive, and mixed loads. Power electronic loads: rectifiers, inverters, and motor drives, Load selection and matching in practical applications. **Power Distribution Systems: (5 Lectures)** Overview of power distribution systems.	**32**

	Principles of measurement of dc voltage and dc current, ac voltage, ac current and resistance. Amplifier-rectifier, and rectifier- amplifier. **Cathode Ray Oscilloscope: (8 Lectures)** 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. Use of CRO for the measurement of voltage (dc and ac frequency, time period. Special features of dual trace, introduction to digital oscilloscope, probes. Digital storage Oscilloscope: Block diagram and principle of working.	Types of transformers, Distribution transformers and substations. Transmission and distribution losses, Safety considerations and protective devices in power distribution.	
TOTAL	**30**	**30**	**60**