Sri Adichunchanagiri First Grade College
Channarayapatna

DEPARTMENT OF PHYSICS

LESSON PLAN FOR THE ACADEMIC YEAR 2023-24(odd-sem)

Programme: B.Sc (NEP)

Course/Paper Name: **Mechanics and Properties of Matter**

Semester: I **Total Hours:52**

Sl. No.	Topic covered	No. of Lecture Hours	Methodology/pedagogy	Date
1	**Units and measurements:** System of units (CGS and SI), measurement of length, mass and time, dimensions of physical quantities, dimensional formulae. Minimum deviation, errors.	13	Black board& Lecture PPT	1st and 2nd week
2	**Momentum and Energy:** Work and energy, Conservation of momentum (linear). Conservation of energy with examples. Motion of rockets		Black board & Lecture PPT	2nd and 3rd week
3	**Special Theory of Relativity:** Constancy of speed of light. Postulates of Special Theory of Relativity. Length contraction. Time dilation. Relativistic addition of velocities		Black board & Lecture PPT	3rd and 4th week
4	**Laws of Motion:** Newton's Laws of motion. Dynamics of single and a system of particles. Centre of mass.	13	Black board, Lecture PPT and Group Discussion	4th and 5th Week
5	**Dynamics of Rigid bodies**: Rotational motion about an axis, Relation between torque and angular momentum, Rotational energy. moment of inertia: M I of a rectangular Lamina and solid cylinders. Flywheel,Theory of compound pendulum and determination of g		Black board/ Lecture PPT	6th week
6	**Gravitation:** 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 (statements). Satellite in a circular orbit		Black board/Lecture PPT/Group Discussion	7th and 8th week

7	**Elasticity: 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. Torsional pendulum-Determination of rigidity modulus and moment of inertia - q, η and σ by Searle's method	13	Black board, Group Discussion and Seminar	8^{th} and 9^{th} week
8	**Surface Tension**: Definition of surface tension. Surface energy, relation between surface tension and surface energy, pressure difference across curved surface example, excess pressure inside spherical liquid drop ,angle of contact	13	Black board and Lecture PPT	9^{th} and 10^{th} week
9	**Viscosity:** Streamline flow, turbulent flow, equation of continuity,determination of coefficient of viscosity by Poisulle's method, Stoke's method. Problems.		Black board/Lecture PPT/Group Discussion	10^{th} and 13^{th} week
	Practical's-Paper I	4 hrs/week	Demonstration	1experiment/week

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DEPARTMENT OF PHYSICS

LESSON PLAN FOR THE ACADEMIC YEAR 2023-24

Programme: B.Sc

Course/Paper Name: Classical Mechanics & Quantum Mechanics-1

Semester: V **Total Hours:64**

Sl. No.	Topic covered	No. of Lectur Hours	Methodology/pedagogy	Date
1	**Introduction to Newtonian Mechanics:** Frames of references, Newton's laws of motion, inertial and non-inertial frames. Mechanics of a particle: Conservation of linear momentum, Angular momentum and torque, conservation of angular momentum, work done by a force, conservative force and conservative energy. **Lagrangian formulation:** Constraints, Holonomic constraints, non-holonomic constraints, Scleronomic and Rheonomic constraints. Generalized coordinates, degrees of freedom, Principle of virtual work, D'Alembert's principle, Lagrange equations. Newton's equation of motion from Lagrange equations, simple pendulum, Atwood's machine and linear harmonic oscillator	15	Black board	1st and 2nd week
2	**Variational principle:** Hamilton's principle, Deduction of Hamilton's principle, Lagrange's equation of motion from Hamilton's principle, Hamilton's principle for non-holonomic systems. **Hamiltonian Mechanics:** The Hamiltonian of a system, Hamilton's equations of motion, Hamilton's equations from variational principle, Integrals of Hamilton's equations, energy integrals, Canonical Transformations, fundamental Poisson Brackets, equations of motion in Poison Brackets	15	Black board & Lecture PPT	3nd week
3	**Matter waves:** de Broglie hypothesis of matter waves, Electron microscope, Wave description of particles by wave packets,			

	Group and Phase velocities and relation between them, Experimental evidence for matter waves: Davisson - Germer experiment, G.P. Thomson's experiment and its significance. **Heisenberg uncertainty principle**: Elementary proof of Heisenberg's relation between momentum and position, energy and time, angular momentum and angular position, illustration of uncertainty principle by Gamma-ray microscope thought experiment. Consequences of the uncertainty relations: Diffraction of electrons at a single slit, why electron cannot exist in nucleus? Two-slit experiment with photons and electrons. Linear superposition principle as a consequence.	15	Black board & Lecture PPT	4th week
4	**Schrödinger equation**: equation of motion of matter waves - Schrodinger wave equation for a free particle in one and three-dimension, time-dependent and time-independent wave equations, Probability current density, equation of continuity and its physical significance. Postulates of Quantum mechanics, States as normalized wave functions. Dynamical variables as linear Hermitian operators (position, momentum, angular momentum, and energy as examples). Expectation values of operators and their time evolution. Ehrenfest theorem (no derivation). Particle in a one-dimensional infinite potential well (derivation), degeneracy in three-dimensional case, particle in a finite potential well (qualitative), Transmission across a potential barrier, the tunnel effect (qualitative), scanning tunnelling microscope, One-dimensional simple harmonic oscillator (qualitative), concept of zero - point energy.	15	Black board & Lecture PPT	5th week
5	**Practical's-Paper V**	4 hours/week	Demonstration	1experiment/week

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DEPARTMENT OF PHYSICS

LESSON PLAN FOR THE ACADEMIC YEAR 2023-24

Programme: B.Sc (NEP)

Course/Paper-6 Name: Elements of Atomic, Molecular & Laser Physics

Semester: V **Total Hours:56**

Sl. No.	Topic covered	No. of Lecture Hours	Methodology /pedagogy	Date
1	**Basic Atomic models** Thomson's atomic model, Rutherford atomic model – Model, Theory of alpha particle scattering, Rutherford scattering formula, Bohr atomic model – postulates, Derivation of expression for radius, total energy of electron, Origin of the spectral lines, Spectral series of hydrogen atom, Effect of nuclear motion on atomic spectra – derivation, Ritz combination principle, Correspondence principle, Critical potentials – critical potential, excitation potential and ionisation potential, Atomic excitation and its types, Franck-Hertz experiment, Somerfield's atomic model – model, Derivation of condition for allowed elliptical orbits.	12	Black board	1st and 2nd week
2	**Vector atomic model and optical spectra:** Vector atom model – model fundamentals, spatial quantisation, spinning electron, Quantum numbers associated with vector atomic model, Coupling schemes – L-S and j-j schemes, Pauli's exclusion principle, Magnetic dipole moment due to orbital motion of electron – derivation, Magnetic dipole moment due to spin motion of electron, Lande's g-factor and its calculation for different states, Stern-Gerlach experiment – Experimental arrangement and Principle, Fine structure of spectral lines with examples, Spin-orbit coupling, Spin-Orbit Interaction – qualitative, Optical spectra – spectral terms, spectral notations, selection rules, intensity rules, Fine structure of the sodium D-line, Zeeman effect: Types,	12	Black board & Lecture PPT	3nd to 4th week

	Experimental study and classical theory of normal Zeeman effect, Zeeman shift expression (no derivation), examples; Stark effect: Experimental study, Types and examples.			
3	**Molecular Physics:** Types of molecules based on their moment of inertia, Types of molecular motions and energies, Born-Oppenheimer approximation, Origin of molecular spectra, Nature of molecular spectra, Theory of rigid rotator – energy levels and spectrum, Qualitative discussion on Non-rigid rotator and centrifugal distortion, Theory of vibrating molecule as a simple harmonic oscillator – energy levels and spectrum, Electronic spectra of molecules – fluorescence and phosphorescence, Raman effect – Stoke's and anti-Stoke's lines, characteristics of Raman spectra, classical and quantum approaches, Experimental study of Raman effect, Applications of Raman effect.	12	Black board & Lecture PPT	5^{th} to 7^{th} week
4	**Laser Physics** Ordinary light versus laser light; Characteristics of laser light; Interaction of radiation with matter - Induced absorption, spontaneous emission and stimulated emission with mention of rate equations; Einstein's A and B coefficients – Derivation of relation between Einstein's coefficients and radiation energy density; Possibility of amplification of light; Population inversion; Methods of pumping; Metastable states; Requisites of laser – energy source, active medium and laser cavity; Difference between Three level and four level lasers with examples; Types of lasers with examples; Construction and Working principle of Ruby Laser and He-Ne Laser; Application of lasers (qualitative) in science & research, isotope separation, communication, fusion, medicine, industry, war and space	12	Black board & Lecture PPT	7^{th} to 8^{th} week
5	**Practical's-Paper 6**	4 hours/week	Demonstration	1experiment/week