Name of Teacher – Dr. Surender Kumar	**S**
Paper – Mechanics	
Class: B.Sc. 1st Semester	**Se**
Week	**Contents**
Week 1	**Fundamentals of Dynamics**: Rigid body, Moment of Inertia, Radius of Gyration, Theorems of perpendicular and parallel axis (with proof),
Week 2	Moment of Inertia of ring, Disc, Angular Disc, Solid cylinder, Solid sphere, Hollow sphere, Rectangular plate, Square plate, Solid cone,
Week 3	Triangular plate, Torque, Rotational Kinetic Energy, Angular momentum
Week 4	Law of conservation of angular momentum, Rolling motion, condition for pure rolling, acceleration of body rolling down an inclined plane, Fly wheel, Moment of Inertia of
Week 5	**Elasticity:** Deforming force, Elastic limit, stress, strain and their types, Hooks law, Module of elasticity Relation between shear angle and angle of twist, elastic energy
Week 6	Elongation produced in heavy rod due to its own weight and elastic potential energy stored in it, Poisson's ratio and its limiting value, Relation between Young modulus,
Week 7	Derive the Relation between Young's modulus, Bulk modulus and Modulus of rigidity. Torque required for twisting cylinder,
Week 8	Bending of beam, bending moment and its magnitude, Bending of cantilever (loaded by a weight W at its free end)
Week 9	weight of cantilever uniformly distributed over its entire length. Dispersion of a centrally loaded beam supported at its ends, determination of elastic constants for material of wire by Searle's method.

Week 10	Special Theory of Relativity: Michelson’s Morley experiments and its outcome
Week 11	Postulate of special theory of relativity, Lorentz Transformation, Simultaneity and order of events, Lorentz contraction
Week 12	Time dilation, Relativistic transformation of velocity, relativistic addition of velocities
Week 13	variation of mass-energy equivalence, relativistic Doppler effect.
Week 14	**Gravitation and central force motion:** Law of gravitation, Potential and field due to spherical shell and solid sphere. Motion of a particle under central force filed,
Week 15	Two body problem and its reduction to one body problem and its solution,determination of g by means of bar pendulum, Normal coordinates and normal modes, Normal modes of vibration for given spring
Week 16	possible angular frequencies of oscillation of two identical simple pendulums of length (l) and small bob of mass (m) joined together with spring of spring constant (k.)
Week 17	Revision & Test

Name of Teacher – Dr. Surender Kumar	**Su**
Paper – Thermodynamics & Statistical Physics	
Class: B.Sc. 3rd Semester	**Ses**

Week	**Contents**
Week 1	UNIT-1: THERMODYNAMICS-I Laws of Thermodynamics: Thermodynamic Description of system: Zeroth Law of thermodynamics. First law of thermodynamics and internal energy, conversion of
Week 2	Various Thermodynamical Processes, Applications of First Law: Work Done during Isothermal and Adiabatic Processes, Compressibility and Expansion Coefficient
Week 3	Reversible and irreversible processes, Second law of thermodynamics, Entropy, Carnot's cycle & Carnot's theorem, Entropy changes in reversible and irreversible
Week 4	Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero. Revision & Test of Unit-1
Week 5	THERMODYNAMICS-II Thermodynamic Potentials: Enthalpy
Week 6	Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations
Week 7	Maxwell's relations and applications - Joule-Thompson Effect, Clausius- Clapeyron Equation,
Week 8	Expression for (CP – CV), CP/CV, TdS equations. Revision and test of Unit-2

Week 9	Statistical Physics-I : Basics idea of probability, Priori probability, Statistical probability, permutation and combination, distinguishable and indistinguishable particles Distribution of N (for N= 2, 3, 4) distinguishable and indistinguishable particles in two boxes of equal size, microstates and macrostates
Week 10	thermodynamical probability, constraints and accessible states, statistical fluctuations, entropy and probability; Concept of phase space, division of phase space into cells, postulates of statistical mechanics; Classical and quantum statistics
Week 11	basic approach to these statistics, Maxwell-Boltzmann statistics applied to an ideal gas in equilibrium-energy distribution law, Maxwell's distribution of speed & velocity (derivation required)
Week 12	most probable speed, average and r.m.s. speed, mean energy for Maxwellian distribution, Revision & Test of Unit-III
Week 13	**Statistical Physics-II** Need of Quantum statistics- classical versus quantum statistics, Bose- Einstein energy distribution Law,
Week 14	Application of B. E. Statistics to Planck's radiation law, Fermi-Dirac energy distribution Law
Week 15	Fermi energy and Fermi temperature; F. D. energy distribution Law for electron gas in metals,
Week 16	zero point energy, average speed (at 0 K) of electron gas, Revision & Test of Unit-IV
Week 17	Revision & Test

Name of Teacher – Dr. Surender Kumar S

Paper – Quantum and Laser Physics

Class: B.Sc. 5th Semester **Session: 2(**

Weeks	Contents
Week 1	Unit I: Origin quantum physics (Experimental basis)Overview, scale of quantum physics, boundary between classical and quantum phenomena, Photon, Photoelectric effect, Compton effect (theory and result), Frank- Hertz experiment, de-Broglie hypothesis
Week 2	Davisson and Germer experiment, G.P.Thomson experiment. Phase velocity, group velocity and their relation. Heisenberg's, uncertainty principle. Time energy and angular momentum, position uncertainty.Uncertainty principle from de Broglie wave. (Wave-particle duality).
Week 3	Gamma Ray Microscope, Electron diffraction from a slit. Derivation of 1-D time-dependent Schrodinger wave equation (subject to force, free particle). Time-independent Schrodinger wave equation, eigen values, eigen functions, wave functions and its significance.
Week 4	Orthogonality and Normalization of function, concept of observer and operator. Expectation values of dynamical quantities, probability current density. Unit II: Application of Schrodinger wave equation: Free particle in one-dimensional box (solution of Schrodinger wave equation, eigen functions, eigen values, quantization of energy and momentum, nodes and anti nodes, zero point energy).
Week 5	One dimensional potential barrier, E > Vo (Reflection and Transmission coefficient); One-dimensional potential barrier, E < Vo (penetration or tunneling coefficient) ; Solution of Schrodinger equation for harmonic oscillator (quantization of energy, Zero-point energy, wave equation for ground state and excited states).
Week 6	Unit III: Laser Physics –I Absorption and emission of radiation, Main features of a laser: Directionality, high intensity, high degree of coherence, spatial and temporal coherence, Einstein's coefficients and possibility of amplification

Week 7	momentum transfer, life time of a level, kinetics of optical absorption ((two and three level rate equation, Fuchbauer landerburg formula).population inversion: A necessary condition for light amplification, resonance cavity, laser pumping, Threshold condition for laser emission, line broadening mechanism, homogeneous and inhomogeneous line broadening (natural, collision and Doppler broadening).
Week 8	Unit IV: Laser Physics – II He-Ne laser and RUBY laser (Principle, Construction and working), Optical properties of semiconductor, Semiconductor laser (Principle, Construction and working),Applications of lasers in the field of medicine and industry.Revision of Syllabus and test

Name of Teacher – Dr. Surender Kumar	**S**
Paper – Nuclear Physics	
Class: B.Sc. 5th Semester	**Session: 20**
Weeks	**Contents**
Week 9	**Unit I: Nuclear Structure and Properties of Nuclei** Nuclear composition (p-e and p-n hypotheses), Nuclear properties; Nuclear size, spin, parity, statistics, magnetic dipole moment, quadruple moment (shape concept).Determination of mass by Bain-Bridge, Bain-Bridge and Jordan mass spectrograph.Determination of charge by Mosley Law
Week 1	Determination of size of nuclei by Rutherford Back Scattering. mass and binding energy, systematic of nuclear binding energy, nuclear stability
Week 1	**Unit II: Nuclear Radiation decay Processes** Alpha-disintegration and its theory. Energetics of alpha-decay, Origin of continuous beta spectrum (neutrino hypothesis), types of beta-decay and energetics of beta-decay. Nature of gamma rays, Energetics of gamma rays
Week 1	**Radiation interaction** Interaction of heavy charged particles (Alpha particles); Energy loss of heavy charged particle (idea of Bethe formula, no derivation),
Week 1	Range and straggling of alpha particles. Geiger-Nuttal law. Interaction of light charged particle (Beta-particle), Energy loss of beta-particles (ionization), Range of electrons, absorption of beta-particles.Interaction of Gamma Ray; Passage of Gamma radiations through matter (Photoelectric, Compton and pair production effect) electron-positron annihilation. Absorption of Gamma rays (Mass attenuation coefficient) and its application.
Week 1	Unit III: Nuclear AcceleratorsLinear accelerator, Tendem accelerator, Cyclotron and Betatron accelerators.Nuclear Radiation Detectors. Gas filled counters; Ionization chamber, proportional counter, G.M. Counter (detailed study), Scintillation counter and semiconductor detector.

Week 1	Unit IV: Nuclear reactions.Nuclear reactions, Elastic scattering, Inelastic scattering, Nuclear disintegration, Photonuclear reaction, Radiative capture, Direct reaction, Heavy ion reactions and spallation Reactions. Conservation laws, Q-value and reaction threshold.
Week 1	Nuclear Reactors.Nuclear Reactors, General aspects of Reactor Design. Nuclear fission and fusion reactors -- Principle, construction, working and use.
Week 1	Revision and Test