Name of Teacher – Dr. Surender Kumar **Subject – Physics**
Paper – Classical Mechanics and Theory of Relativity
Class : B.Sc. 1ST Semester **Session: 2020-21**

Weeks With Months	Contents
NOV 16-21	**Unit 1: Basic concepts of Classical mechanics** Mechanics of single and system of particles, Conversion law of linear momentum,
NOV 23-28	Angular momentum and mechanical energy for a particle and a system of particles, Centre of Mass and equation of motion, Constrained Motion.
NOV 30- DEC 5	**Unit2: Generalized Notations** Degrees of freedom and Generalized coordinates, Transformation equations, Generalized Displacement, Velocity, Acceleration, Momentum
DEC 7-12	Force and Potential, Hamilton's variational principle, Lagrange's equation of motion from Hamilton's principle, Linear Harmonic oscillator, Simple pendulum, Atwood's machine.
DEC 14-19	**Unit 3: Theory of relativity** Frame of reference, limitation of Newton's law of motion, Inertial frame of reference, Galilean transformation, Frame of reference with linear acceleration
DEC 21-26	Classical relativity- Galilean invariance, Transformation equation for a frame of reference- inclined to an inertial frame and Rotating frame of reference, Non-inertial frames-The accelerated Frame of reference and rotating frame of reference
DEC 28- JAN 2	Effect of centrifugal and coriolis forces due to Earth's rotation, Fundamental frame of reference, Michelson- Morley's experiment, concept of Einstein's relativity.
JAN 4-9	**Unit 4: Applications of theory of relativity** Special theory of relativity, Lorentz co-ordinate and physical significance of Lorentz invariance, Length Contraction, Time Dilation
JAN 11-16	Twin Paradox, Velocity addition theorem, Variation of mass with velocity, Mass energy equivalence, Transformation of relativistic momentum and energy,
JAN 18-23	Relation between relativistic momentum and energy, Mass, velocity, momentum and energy of zero rest mass.
JAN 25-30	REVISION AND TEST OF UNIT 1 TO 4

Name of Teacher – Dr. Surender Kumar **Subject – Physics**
Paper – Electricity, Magnetism and Electromagnetic theory
Class : B.Sc. 1ST Semester **Session: 2020-21**

Weeks With Months	Contents
JAN 11-16	**Unit I: Vector background and Electric field** Gradient of a scalar and its physical significance, Line, Surface and Volume integrals of a vector and their physical significance, Flux of a vector field, Divergence and curl of a vector and their physical significance
JAN 18-23	Gauss's divergence theorem, Stoke's theorem. Derivation of electric field E from potential as gradient, Derivation of Laplace and Poisson equations, Electric flux, Gauss's Law, Mechanical force of charged surface, Energy per unit volume.
JAN 25-30	**Unit 2: Magnetism** Magnetic induction, Magnetic flux, Solenoidal nature of vector field of induction, properties of (i) , (ii) , Electronic theory of dia and paramagnetism
FEB 1-6	Domain theory of ferromagnetism (Langevin's theory), Cycle of magnetization- hystresis loop (Energy dissipation, Hystresis loss and importance of Hystresis Curve)
FEB 8 -13	**Unit 3: Electromagnetism** Maxwell equations and their derivations, Displacement current, Vector and Scalar potentials, Boundary conditions at interface between two different media, Propagation of electromagnetic wave (Basic idea, no derivation), Poynting vector and Poynting theorem.
FEB 15-20	**Unit 4: A. C. Analysis** A.C. circuit analysis using complex variable with (a) Capacitance and Resistance (CR) (b) Resistance and Inductance (LR)
FEB 22- 28	(c) Capacitance and Inductance (LC) and (d) Capacitance, Inductance and Resistance (LCR), Series and parallel resonance circuit, Quality factor (sharpness of resonance). REVISION AND TEST OF UNIT 1 TO 4

Name of Teacher – Dr. Surender Kumar **Subject – Physics**

Paper – Computer Programming and Thermodynamics

Class : B.Sc. 3rd Semester **Session: 2020-21**

Weeks With Months	Contents
AUG 4-8	UNIT-1: Computer Programming Computer organization, Binary representation. Algorithm development
AUG 10-15	Flow charts and their interpretation, FORTRAN Preliminaries: Integer and floating point arithmetic expression
AUG 17-22	built in functions, executable and non-executable statements, input and output statements
AUG 24-29	Formats, IF, DO and GO TO statements, Dimension arrays, statement function and function subprogram.
AUG 31- SEP 5	UNIT –2: Applications of FORTRAN programming Algorithm, Flow Chart and Programming for Print out of natural numbers
SEP 7-12	Range of the set of given numbers, Ascending and descending order, Mean and standard deviation, Least square fitting of curve, Roots of quadratic equation
SEP 14-19	Product of two matrices, Numerical integration (Trapezoidal rule and Simpson 1/3 rule)
SEP 21-26	UNIT-3: Thermodynamics-I Thermodynamic system and Zeroth law of thermodynamics. First law of thermodynamics and its limitations, reversible and irreversible process
SEP 28- OCT 3	Second law of thermodynamics and its significance, Carnot theorem, Absolute scale of temperature, Absolute Zero and magnitude of each division on work scale and perfect gas scale, Joule's free expansion, , Joule Thomson effect, Joule-Thomson (Porous plug) experiment
OCT 5-10	conclusions and explanation, analytical treatment of Joule Thomson effect. Entropy, calculations of entropy of reversible and irreversible process , T-S diagram, entropy of a perfect gas,
OCT 12-17	Nernst heat law(third law of thermodynamics), Liquefaction of gases, (oxygen, air, hydrogen and helium), Solidification of He below 4K, Cooling by adiabatic demagnetization.
OCT 19-24	UNIT-4: Thermodynamics-II Derivation of Clausius-Clapeyron and Clausius latent heat equation and their significance,specific heat of saturated vapours,phase diagrame and triple point of a substance, development of Maxwell thermodynamical relations.
OCT 26-31	Thermodynamical functions: Internal energy (U), Helmholtz function (F), Enthalpy (H), Gibbs function (G) and the relations between them, derivation of Maxwell thermodynamical relations from thermodynamical functions,Application of Maxwell relations: relations between two specific heats of gas,
NOV 2-7	Derivation of Clausius-Clapeyron and Clausius equation,variation of intrinsic energy with volume for (i) perfect gas (ii)Vanderwall gas (iii)solids and liquids ,

	derivation of Stefans law, adiabatic compression and expention of gas & deduction of theory of Joule Thomson effect.
JAN 4-9	Revision and Test of Unit 1
JAN 11-16	Revision and Test of Unit 2
JAN 18-23	Revision and Test of Unit 3
JAN 25-30	Revision and Test of Unit 4

Name of Teacher – Dr. Surender Kumar **Subject – Physics**

Paper – Wave and optics I

Class : B.Sc. 3rd Semester **Session: 2020-21**

Weeks With Months	Contents
OCT 26-31	Unit-1: Interference I Interference by Division of Wave front: Young's double slit experiment, Coherence, Conditions of interference, Fresnel's biprism and its applications to determine the wavelength of sodium light and thickness of a mica sheet,
NOV 2-7	Lloyd's mirror, Difference between Bi-prism and Llyod mirror fringes, phase change on reflection.
NOV 9-14	Unit 2: Interference II Interference by Division of Amplitude: Plane parallel thin film, production of colors in thin films, classification of fringes in films
NOV 16-21	Interference due to transmitted light and reflected light, wedge shaped film, Newton's rings
NOV 23-28	Interferometer: Michelson's interferometer and its applications to (i) Standardization of a meter (ii) determination of wavelength.
NOV 30- DEC 5	Unit- 3: Diffraction I Fresnel's diffraction: Fresnel's assumptions and half period zones, rectilinear propagation of light, zone plate
DEC 7-12	diffraction at a straight edge, rectangular slit and circular aperture, diffraction due to a narrow slit and wire.
DEC 14-19	Unit -4: Diffraction II Fraunhoffer diffraction: single-slit diffraction, double-slit diffraction, N-slit diffraction, plane transmission granting spectrum
DEC 21-26	Dispersive power of grating, limit of resolution, Rayleigh's criterion,
DEC 28- JAN 2	Resolving power of telescope and a grating. Differences between prism and grating spectra.
JAN 4-9	Revision of Unit 1 and Test
JAN 11-16	Revision of Unit 2 and Test
JAN 18-23	Revision of Unit 3 and Test
JAN 25-30	Revision of Unit 4 and Test

Name of Teacher – Dr. Surender Kumar **Subject – Physics**

Paper – Quantum and Laser Physics

Class : B.Sc. 5th Semester **Session: 2020-21**

Weeks With Months	Contents
AUG 4-8	**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
AUG 10-15	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).
AUG 17-22	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.
AUG 24-29	Orthogonality and Normalization of function, concept of observer and operator. Expectation values of dynamical quantities, probability current density
AUG 31- SEP 5	**Unit II: Application of Schrodinger wave equation:** (i) 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).
SEP 7-12	(ii) One dimensional step potential E > Vo (Reflection and Transmission coefficient) (iii) One dimensional step potential E < Vo (penetration depth calculation).
SEP 14-19	(iv) One dimensional potential barrier, E > Vo (Reflection and Transmission coefficient) (v) One-dimensional potential barrier, E < Vo (penetration or tunneling coefficient). (vi) Solution of Schrodinger equation for harmonic oscillator (quantization of energy, Zero-point energy, wave equation for ground state and excited states).
SEP 21-26	**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
SEP 28- OCT 3	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,
OCT 5-10	laser pumping, Threshold condition for laser emission, line broadening mechanism, homogeneous and inhomogeneous line broadening (natural, collision and Doppler broadening).

JAN 4-9	**Unit IV: Laser Physics – II** He-Ne laser and RUBY laser (Principle, Construction and working), Optical properties of semiconductor,
JAN 11-16	Semiconductor laser (Principle, Construction and working), Applications of lasers in the field of medicine and industry.
JAN 18-23	Revision and test of Unit 1 and 2
JAN 25-30	Revision and test of Unit 3 and 4

Name of Teacher – Dr. Surender Kumar **Subject – Physics**

Paper – Nuclear Physics

Class : B.Sc. 5th Semester **Session: 2020-21**

Weeks With Months	Contents
OCT 5-10	**Unit I: Nuclear Structure and Properties of Nuclei** Nuclear composition (p-e and p-n hypotheses), Nuclear properties; Nuclear size, spin,parity, statistics,
OCT 12-17	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
OCT 19-24	Determination of size of nuclei by Rutherford Back Scattering. mass and binding energy, systematic of nuclear binding energy, nuclear stability
OCT 26-31	**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
NOV 2-7	**Radiation interaction** Interaction of heavy charged particles (Alpha particles); Energy loss of heavy charged particle (idea of Bethe formula, no derivation),
NOV 9-14	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.
NOV 16-21	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.
NOV 23-28	**Unit III: Nuclear Accelerators** Linear accelerator, Tendem accelerator, Cyclotron and Betatron accelerators. **Nuclear Radiation Detectors.** Gas filled counters; Ionization chamber,
NOV 30- DEC 5	proportional counter, G.M. Counter (detailed study), Scintillation counter and semiconductor detector.
DEC 7-12	**Unit IV:** **Nuclear reactions.** Nuclear reactions, Elastic scattering, Inelastic scattering, Nuclear disintegration, Photonuclear reaction
DEC 14-19	Radiative capture, Direct reaction, Heavy ion reactions and spallation Reactions. Conservation laws, Q-value and reaction threshold**.**
DEC 21-26	**Nuclear Reactors.** Nuclear Reactors, General aspects of Reactor Design.

DEC 28- JAN 2	Nuclear fission and fusion reactors, (Principle, construction, working and use).
JAN 4-9	Revision and Test of Unit 1
JAN 11-16	Revision and Test of Unit 2
JAN 18-23	Revision and Test of Unit 3
JAN 25-30	Revision and Test of Unit 4