Schedule of Teaching

Department of Physics

Govt. College Jhandutta Distt. Bilaspur (H.P.)

Prepared By:

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Class: BSc First Year

Course: Mechanics (PHYS101)

Lectures per Week: 3

Course Outcomes (CO):

After the completion of this course students should be able to;

CO-1. Know the Coordinate systems and motion of a particle.
CO-2. To understand the Space Time Symmetry and Conservation Laws
CO-3. Discuss the Gravitation and Inverse Square Force Law.
CO-4. Rotational Motion and Kinematics of Elastic and Inelastic Collisions
CO-5. Study the Special Theory of Relativity.

S.No.	Topic	Week	Month
1.	1st order homogeneous differential equations. 2nd order homogeneous differential equations with constant coefficients.	First Week	July
2.	Volume, velocity and acceleration in Cartesian and Spherical co-ordinate systems, Solid angle	Second Week	
3.	Relationship of conservation laws and symmetries of space and time.	Third Week	
4.	Inertial frames of reference, Galilean transformation and Galilean invariance.	Fourth Week	
5.	Non-inertial frames, Coriolis force and its applications; Foucault's pendulum.	First Week	August
6.	Newton's Law of Gravitation, Various forces in nature (qualitative).	Second Week	
7.	Central and non-central forces, Inverse square force.	Third Week	
8.	Centre of mass. Equivalent one body problem	Fourth Week	
9.	Reduced mass, angular momentum in central force field. Equation of motion under a force law.	First Week	September
10.	Equation of orbit and turning points. relationship between eccentricity and energy Kepler's laws	Second Week	
11.	Angular velocity, angular momentum, Torque, Conservation of angular momentum.	Third Week	
12.	Elastic and inelastic collisions, coefficient of restitution, Elastic collisions in laboratory and C.M. systems.	Fourth Week	
13.	Velocities, angle and energies in elastic collisions in C.M. and lab. Systems.	First Week	October
14.	Classical Scattering: Cross- section for elastic scattering, Rutherford scattering (with derivation).	Second Week	

15.	Concept of stationary universal frame of reference and search for ether.	Third Week	
16.	Michelson- Morley experiment, postulates of special theory of relativity	Fourth Week	
17.	Lorentz transformations. Observer in relativity. Relativity of simultaneity.	First Week	November
18.	Length contraction, Time dilation.	Second Week	
19.	Relativistic addition of velocities.	Third Week	
20.	Relativistic Doppler effect.	Fourth Week	
21.	Variation of mass with velocity and mass energy equivalence.	First Week	December
22.	Increase of mass in an inelastic collision.	Second Week	
23.	MTT	Third Week	
24.	MTT	Fourth Week	
25.	Relativistic momentum and energies.	Second Week	February
26.	Transformation of momentum, energy.	Third Week	
27.	Minskowsky space.	Fourth Week	
28.	Revision	First Week	March
29.	Revision	Second Week	
30.	Revision	Third Week	
31.	Revision	Fourth Week	

There will be class test at the end of each unit.

Course: Electricity, Magnetism and EMT (PHYS102)

Lectures per Week: 3

Course Outcomes (CO):

After the completion of this course students should be able to;

CO-1. To understand the Vector Analysis.
CO-2. To understand the Electric Current and Fields of Moving charges.
CO-3. Know the fundamental principles of Magnetism.
CO-4. To study Electrostatic Fields in Dielectrics.
CO-5. To understand Magnetic Fields in Matter.

S.No.	Topic	Week	Month
1.	Review of vector algebra (Scalar and Vector product)	First Week	July
2.	Gradient, divergence, Curl and their significance	Second Week	
3.	Vector Integration, Line, surface and volume integrals of Vector fields	Third Week	
4.	Gauss-divergence theorem, Stokes's theorem, Green's theorem	Fourth Week	

5.	Significance of electrostatic force, Electrostatic Field, electric flux	First Week	August
6.	Gauss's theorem of electrostatics. Applications of Gauss theorem- Electric field due to point charge, infinite line of charge, uniformly charged spherical shell and solid sphere	Second Week	
7.	Applications of Gauss theorem- plane charged sheet, charged conductor, electrostatic potential, electrostatic potential energy	Third Week	
8.	Electric potential due to a dipole and quadrupole, long uniformly changed wire, charged disc.	Fourth Week	
9.	Electric potential energy. Electric field as a gradient of a scalar potential, Calculation of electric field due to a point charge and a dipole from potential.	First Week	September
10.	Method of Electrical Images. Poisson and Laplace equations.	Second Week	
11.	Current and current density. Continuity equation; $\nabla J + \partial\rho/\partial t = 0$. Microscopic form of Ohm's law ($J \alpha E$) and conductivity. Failure of Ohms law and its explanation. Invariance of charge	Third Week	
12.	Ampere circuital law and its applications. Hall Effect, Expression for Hall constant and its significance.	Fourth Week	
13.	Divergence and curl of magnetic field B. Vector potential: Definition of vector potential A and derivation.	First Week	October
14.	E in different frames of reference. Field of a point charge moving with constant velocity.	Second Week	
15.	Field of charge that starts or stops (qualitative). Interaction between moving charge and force between parallel currents.	Third Week	
16.	Definition. and its use in calculation of change in magnetic field at a current sheet. Transformation equations of E and B from one frame of reference to another	Fourth Week	

17.	Dielectrics, parallel plate capacitor with a dielectric, dielectric constant, polarization and polarization vector, displacement vector D, molecular interpretation of Clausius - Mossotti equation.	First Week	November
18.	Boundary conditions satisfied by E and D at the interface between two homogenous dielectrics, illustration through a simple example	Second Week	
19.	Polarization of matter. Atomic and molecular dipoles, induced. Dipole moment and atomic polarizability, Electric susceptibility and polarization vector	Third Week	
20.	Capacity of a capacitor filled with Dielectrics. Dielectrics and Gauss's law Displacement vector- Establishment of relation $\nabla.D = \rho$ free. Energy stored in a dielectric medium, Behaviour of various substances in magnetic fields.	Fourth Week	
21.	Definition of M and H and their relation to free and bound currents, Magnetic permeability and susceptibility and their interrelation.	First Week	December
22.	Orbital motion of electrons and diamagnetism, Electron spin and paramagnetic. Ferromagnetism. Domain theory of ferromagnetism, magnetization curve, hysterics loss, ferrites.	Second Week	
23.	MTT	Third Week	
24.	MTT	Fourth Week	
25.	Displacement current, Maxwell's equations and its physical interpretation, EM waves and wave equation in a medium having finite permeability and permittivity but with conductivity $\sigma = 0$.	Second Week	February
26.	Poynting vector, Poynting theorem, Impedance of a dielectric to EM waves, EM waves in conducting medium and skin depth. EM waves velocity in	Third Week	

	a conductor and anomalous dispersion.		
27.	Reflection and Transmission of EM waves at a boundary of two dielectric media for normal and oblique incidence of reflection of EM waves from the surface of a conductor at normal incidence.	Fourth Week	
28.	Revision	First Week	March
29.	Revision	Second Week	
30.	Revision	Third Week	
31.	Revision	Fourth Week	

There will be class test at the end of each unit.

Class: BSc2nd Year

Course: Statistical and Thermal Physics (PHYS201)

Lectures per Week: 3

Course Outcomes (CO):

After the completion of this course students should be able to;

CO-1. Understand Basic Ideas of Statistical Physics.
CO-2. Gain the knowledge of Distribution of Particles in Compartments.
CO-3. To study different types of Statistics in Physics.
CO-4. To know Entropy and Laws of Thermodynamics.
CO-5. Understand Maxwell's Thermodynamic Relations and Their Applications.
CO-6. To study applications of thermodynamics relations.

S.No.	Topic	Week	Month
1.	Scope of statistical physics, basic ideas about probability, distribution of four distinguishable particles in two compartments of equal sizes.	First Week	July
2.	Concept of macro-states, micro-states.	Second Week	
3.	Thermodynamic probability, effect of constraints on the system.	Third Week	
4.	Distribution of n particles in two compartments, Deviation from the state of maximum probability.	Fourth Week	
5.	Equilibrium state of a dynamic system, distribution of n	First Week	August

	distinguishable particles in k compartments of unequal sizes.		
6.	Phase space and division into elementary cells. Three kinds of statistics. The basic approach in the three statistics.	Second Week	
7.	M-B. Statistics applied to an ideal gas in equilibrium, experimental verification of the Maxwell Boltzmann's law of distribution of molecular speeds.	Third Week	
8.	Need for quantum statistics, h as a natural constant and its implications, indistinguishability of particles and its implications. B-E statistics	Fourth Week	
9.	Derivation of Planck's law of radiation, deduction of Wien's distribution law and Stefan's law from Plank's law	First Week	September
10.	Fermi-Dirac statistics. Applications to liquid helium, free electrons gas (Fermi level and Fermi Energy), Comparison of M-B, B-E, F-D statistics.	Second Week	
11.	Application of thermodynamics to the thermoelectric effect, change of entropy along a reversible path in a p-v diagram	Third Week	
12.	Entropy of a perfect gas, equation of state of ideal gas from simple statistical considerations, heat death of the universe.	Fourth Week	
13.	Statistical definition of entropy, change of entropy of system, additive nature of entropy, law of increase of entropy.	First Week	October
14.	Reversible and irreversible processes, example of reversible and irreversible processes.	Second Week	
15.	Work done in a reversible process, example of entropy in natural process, entropy and disorder.	Third Week	
16.	Thermodynamic Potentials: Enthalpy, Gibbs, Helmholtz and Internal Energy functions	Fourth Week	
17.	Derivation of Maxwell's thermodynamic relations.	First Week	November

18.	Cooling produced by adiabatic stretching.	Second Week	
19.	Adiabatic compression.	Third Week	
20.	Adiabatic Stretching of a wire.	Fourth Week	
21.	Stretching of thin films, change of internal energy with volume.	First Week	December
22.	Clausius-Clapeyron Equation	Second Week	
23.	MTT	Third Week	
24.	MTT	Fourth Week	
25.	Thermo dynamical treatment of Joule- Thomson effect for liquification of Helium	Second Week	February
26.	Production of very low temperatures by adiabatic demagnetization.	Third Week	
27.	TdS equations	Fourth Week	
28	Revision	First Week	March
29.	Revision	Second Week	
30.	Revision	Third Week	
31.	Revision	Fourth Week	

There will be class test at the end of each unit.

Course: Waves and Optics (PHYS202)

Lectures per Week: 3

Course Outcomes (CO):

After the completion of this course students should be able to;

CO-1. To know the Simple harmonic motion.
CO-2. To understand The Forced Oscillator and coupled oscillators.
CO-3. To study the Wave Optics.
CO-4. To study the diffraction and polarization.

S.No.	Topic	Week	Month
1.	Characteristics and graphical representation of SHM	First Week	July
2.	Phase relation between displacement, velocity and acceleration of a particle, executing SHM	Second Week	
3.	SHM oscillator (mass attached to a spring placed on horizontal frictionless surface). energy of a simple harmonic oscillator.	Third Week	
4.	Solution of the differential equation of SHM. Average kinetic	Fourth Week	

	energy, average potential energy and total energy.		
5.	Damped oscillations. differential equation of motion of one dimensional damped harmonic mechanical oscillator.	First Week	August
6.	Types of damping. damped harmonic electric oscillator (differential equation and its solutions).	Second Week	
7.	Determination of the damping constants. Logarithmic decrement. Relaxation time. The quality factor.	Third Week	
8.	Power dissipation in a damped harmonic oscillator when damping is weak, Relation between power dissipation energy and relaxation time of damped harmonic oscillator.	Fourth Week	
9.	Transient and steady behaviour of forced oscillator, Displacement and velocity variation with driving force frequency	First Week	September
10.	Variation of phase with frequency. Power supplied to an oscillator and its variation with frequency.	Second Week	
11.	Q- value and band width. Q-value as an amplification factor, Stiffness coupled pendulums	Third Week	
12.	Normal co-ordinates and normal modes of vibration.	Fourth Week	
13.	Inductance coupling of electrical oscillators	First Week	October
14.	The type of waves. The wave equation and its solution	Second Week	
15.	Characteristic impedance of a string. Impedance matching. Reflection and transmission of energy	Third Week	
16.	Reflected and transmitted energy coefficients. Standing waves on a string of fixed length. Energy of a vibrating string. Wave velocity and group velocity.	Fourth Week	
17.	Electromagnetic nature of light, Definition and Properties of wave front, Huygens Principle.	First Week	November

18.	Division of wavefront and division of amplitude. Young's Double Slit experiment	Second Week	
19.	Lloyd's Mirror and Fresnel's Biprism. Phase change on reflection: Stokes's treatment	Third Week	
20.	Interference in Thin Films: parallel and wedge-shaped films. Fringes of equal inclination (Haidinger Fringes); Fringes of equal thickness (Fizeau Fringes).	Fourth Week	
21.	Newton's Rings: measurement of wavelength and refractive index. Michelson's Interferometer.	First Week	December
22.	Fraunhofer diffraction: Single slit; Double Slit. Multiple slits & Diffraction grating, Dispersive power of diffraction grating, Fresnel Diffraction	Second Week	
23.	MTT	Third Week	
24.	MTT	Fourth Week	
25.	Half-period zones. Zone plate. Fresnel Diffraction pattern of a straight edge, a slit and a wire using half-period zone analysis.	Second Week	February
26.	Transverse nature of light waves. Unpolarized and plane polarized light, production of polarized light, Wire grid polarizer, Polaroid, Effect of intensity of light passing through Polaroid, Malus‟ law, double refraction; ordinary ray and extraordinary ray, positive and negative crystals	Third Week	
27.	Birefringence, Nicol Prism, quarter wave plate and half wave plate, Polarization by reflection (Brewster law), polarization by scattering, Circular and elliptical polarization, production of elliptically polarized and circularly polarized light.	Fourth Week	
28.	Revision	First Week	March
29.	Revision	Second Week	
30.	Revision	Third Week	
31.	Revision	Fourth Week	

There will be class test at the end of each unit.

Course: Physics Workshop Skills (PHYS203)

Lectures per Week: 2

Course Outcomes (CO):

After the completion of this course students should be able to;

CO-1. To learn Measuring units and their conversion to SI and CGS.
CO-2. To understand the Concept of workshop practice.
CO-3. Understand the concept of Electrical and Electronic Skill.
CO-4. Study the gear system, wheel, Fixing of gears with motor axel, Lever mechanism.

S.No.	Topic	Week	Month
1.	Measuring units, conversion to SI and CGS	First Week	July
2.	Familiarization with meter scale, Vernier calliper, Screw gauge and their utility	Second Week	
3.	Measure the dimension of a solid block, volume of cylindrical beaker/glass, diameter of a thin wire, thickness of metal sheet, etc	Third Week	
4.	Use of Sextant to measure height of buildings, mountains, etc.	Fourth Week	
5.	Concept of workshop practice	First Week	August
6.	Overview of manufacturing methods: casting, foundry, machining, forming and welding	Second Week	
7.	Types of welding joints and welding defects	Third Week	
8.	Common materials used for manufacturing like steel, copper, iron, metal sheets, composites and alloy, wood.	Fourth Week	
9.	Concept of machine processing, introduction to common machine tools like lathe, shaper, drilling, milling and surface machines	First Week	September
10.	Cutting tools, lubricating oils. Cutting of a metal sheet using blade.	Second Week	
11.	Smoothening of cutting edge of sheet using file.	Third Week	
12.	Drilling of holes of different diameter in metal sheet and wooden block	Fourth Week	
13.	Use of bench vice and tools for fitting	First Week	October
14.	Make funnel using metal sheet.	Second Week	

15.	Use of Multimeter.	Third Week	
16.	Soldering of electrical circuits having discrete components (R, L, C, diode) and ICs on PCB	Fourth Week	
17.	Operation of oscilloscope	First Week	November
18.	Making regulated power supply	Second Week	
19.	Timer circuit	Third Week	
20.	Electronic switch using transistor and relay	Fourth Week	
21.	Introduction to prime movers	First Week	December
22.	Mechanism of prime movers	Second Week	
23.	MTT	Third Week	
24.	MTT	Fourth Week	
25.	Gear system, wheel, Fixing of gears with motor axel. Lever mechanism	Second Week	February
26.	Lifting of heavy weight using lever. braking systems	Third Week	
27.	Pulleys, working principle of power generation systems. Demonstration of pulley experiment.	Fourth Week	
28.	Revision	First Week	March
29.	Revision	Second Week	
30.	Revision	Third Week	
31.	Revision	Fourth Week	

There will be class test at the end of each unit.

Course: Electrical Circuits and Network Skills (PHYS205)

Lectures per Week: 2

Course Outcomes (CO):

After the completion of this course students should be able to;

CO-1. To understand Basic Electricity Principles.
CO-2. Understanding Electrical Circuits.
CO-3. To learn Electrical Drawing and Symbols.
CO-4. To study Generators and Transformers, Electric Motors.
CO-5. To understand the concept of Electrical Wiring.

S.No.	Topic	Week	Month
1.	Voltage, Current, Resistance, and Power	First Week	July
2.	Ohm's law. Series, parallel, and series-parallel combinations.	Second Week	
3.	AC Electricity and DC Electricity	Third Week	

4.	Familiarization with multimeter, voltmeter and ammeter.	Fourth Week	
5.	Main electric circuit elements and their combination	First Week	August
6.	Rules to analyze DC sourced electrical circuits	Second Week	
7.	Current and voltage drop across the DC circuit elements.	Third Week	
8.	Single-phase and three-phase alternating current sources.	Fourth Week	
9.	Rules to analyze AC sourced electrical circuits. Real, imaginary and complex power components of AC source	First Week	September
10.	Power factor, Saving energy and money.	Second Week	
11.	Electrical Drawing and Symbols: Drawing symbols. Blueprints	Third Week	
12.	Reading Schematics. Ladder diagrams. Electrical Schematics. Power circuits. Control circuits	Fourth Week	
13.	Reading of circuit schematics. Tracking the connections of elements and identify current flow and voltage drop.	First Week	October
14.	DC Power sources. AC/DC generators	Second Week	
15.	Inductance, capacitance, and impedance. Operation of transformers.	Third Week	
16.	Single-phase, three-phase & DC motors. Basic design. Interfacing DC or AC sources to control heaters & motors, Speed & power of ac motor	Fourth Week	
17.	Resistors, inductors and capacitors. Diode and rectifiers	First Week	November
18.	Components in Series or in shunt. Response of inductors and capacitors with DC or AC sources	Second Week	
19.	Relays, Fuses and disconnect switches, Circuit breakers	Third Week	
20.	Overload devices. Ground-fault protection, Grounding and isolating. Phase reversal.	Fourth Week	
21.	Surge protection. Interfacing DC or AC sources to control elements (relay protection device)	First Week	December

22.	Different types of conductors and cables. Basics of wiring-Star and delta connection.	Second Week	
23.	MTT	Third Week	
24.	MTT	Fourth Week	
25.	Voltage drop and losses across cables and conductors. Instruments to measure current, voltage, power in DC and AC circuits	Second Week	February
26.	Insulation. Solid and stranded cable. Conduit. Cable trays. Splices: wirenuts, crimps,	Third Week	
27.	Terminal blocks, split bolts, and solder. Preparation of extension board.	Fourth Week	
28.	Revision	First Week	March
29.	Revision	Second Week	
30.	Revision	Third Week	
31.	Revision	Fourth Week	

There will be class test at the end of each unit.

Class: BSc Third Year

Course: Solid State Physics and Electronics (PHYS302)

Lectures per Week: 3

Course Outcomes (CO):

After the completion of this course students should be able to;

CO-1. Understand Crystal Structure and different types of Crystal Bonding.
CO-2. Understand and explain Elementary Lattice Dynamics.
CO-3. Learn and elaborate Free electron theory of metals.
CO-4. Know and explain Band Theory of Metals and concept of Superconductivity.
CO-5. Understand and elaborate the concept of Junction diodes and Transistors.
CO-6. Learn and understand the applications of Amplifiers and Oscillators.

S.No.	Topic	Week	Month
1.	Lattice Translation Vectors. Lattice with a Basis, Unit Cell, Types of Lattices,	First Week	July
2.	Miller Indices. Reciprocal Lattice, Brillouin Zones	Second Week	
3.	Diffraction of X-rays by Crystals, Bragg's Law, Laue pattern, Laue equation	Third Week	
4.	Atomic and Geometrical Factor.	Fourth Week	

5.	Potential between a pair of atoms, Lennard-Jones potential	First Week	August
6.	Ionic, Covalent, Vander - Waal's bonded crystals, Calculation of cohesive energy for ionic and inert gas system	Second Week	
7.	Lattice Vibrations and Phonons: Linear Monoatomic and Diatomic Chains. Acoustical and Optical Phonons.	Third Week	
8.	Qualitative Description of the Phonon Spectrum in Solids. Dulong and Pettit's Law,	Fourth Week	
9.	Einstein and Debye theories of specific heat of solids, T3 law, Free electron theory of metals: Classical picture, Fermi gas, density of states	First Week	September
10.	Fermi energy and fermi velocity, electronic contribution to specific heat of metals, Kronig Penny model	Second Week	
11.	Brillouin zones, electrons in periodic structure, energy bands, energy gaps, Effective mass of electrons and holes, metals, insulators, p and n type Semiconductors effective mass of electron, mobility.	Third Week	
12.	Experimental Results. Critical Temperature. Critical magnetic field, Meissner effect.	Fourth Week	
13.	Type I and type II Superconductors, London's Equation and Penetration Depth.	First Week	October
14.	Isotope effect. cooper pairs, BCS theory	Second Week	
15.	PN junctions, V-I characteristics, Zener diode, voltage regulation, tunnel diode, LED and LCD, Solar cell, diode as circuit element, load line concept	Third Week	
16.	Rectifiers: Half Wave, full wave and bridge rectifier, efficiency and ripple factor, filter circuits.	Fourth Week	
17.	Characteristics of a transistor in CB, CE and CC mode, idea of equivalent circuits, α and β of BJT, common emitter amplifier.	First Week	November

18.	Field Effect Transistor: working of JFET, voltage ampere curves, biasing JFET	Second Week	
19.	ac operation of JFET, depletion and enhancement mode, MOSFET, FET amplifier	Third Week	
20.	Small signal amplifiers: General principles of operation, classification, distortion	Fourth Week	
21.	RC coupled amplifier, gain frequency response, input and output impedance. Multistage amplifiers, transformed coupled amplifiers	First Week	December
22.	Equivalent circuits at low, medium and high frequencies, emitter follower, low frequency common source and common drain amplifier	Second Week	
23.	MTT	Third Week	
24.	MTT	Fourth Week	
25.	Noise in electronic circuits. Feedback in amplifiers; negative feedback and stability.	Second Week	February
26.	Braukhausen criteria for oscillations, Tuned collector, Hartley and Colpitts oscillators, phase shift oscillators,	Third Week	
27.	Operational amplifiers, inverting and non-inverting amplifiers, operational amplifier as adder, subtractor, comparator, integrator and differentiator.	Fourth Week	
28.	Revision	First Week	March
29.	Revision	Second Week	
30.	Revision	Third Week	
31.	Revision	Fourth Week	

There will be class test at the end of each unit.

Course: Quantum Mechanics (PHYS305)

Lectures per Week: 3

Course Outcomes (CO):

After the completion of this course students should be able to;

CO-1. Understand the Time dependent Schrodinger equation.
CO-2. Know the bound states in an arbitrary potential.
CO-3 To understand Quantum theory of hydrogen-like atoms.

CO-4. To study Atoms in Electric and Magnetic Fields.
CO-5. Learn the behaviour of Atoms in External Magnetic Fields.

S.No.	Topic	Week	Month
1.	Time dependent Schrodinger equation and dynamical evolution of a quantum state	First Week	July
2.	Properties of Wave Function. Interpretation of Wave Function	Second Week	
3.	Probability and probability current densities in three dimensions; Conditions for Physical Acceptability of Wave Functions	Third Week	
4.	Normalization. Linearity and Superposition Principles. Eigenvalues and Eigenfunctions.	Fourth Week	
5.	Position, momentum & Energy operators; commutator of position and momentum operators	First Week	August
6.	Expectation values of position and momentum. Wave Function of a Free Particle	Second Week	
7.	Time independent Schrodinger equation-Hamiltonian	Third Week	
8.	Stationary states and energy eigenvalues; expansion of an arbitrary wavefunction as a linear combination of energy eigenfunctions	Fourth Week	
9.	General solution of the time dependent Schrodinger equation in terms of linear combinations of stationary states; Application to the spread of Gaussian wavepacket for a free particle in one dimension; wave packets	First Week	September
10.	Fourier transforms and momentum space wavefunction; Position-momentum uncertainty principle.	Second Week	
11.	General discussion of bound states in an arbitrary potential	Third Week	
12.	Continuity of wave function, boundary condition and emergence of discrete energy levels	Fourth Week	
13.	Application to one-dimensional problem- square well potential	First Week	October

14.	Quantum mechanics of simple harmonic oscillator-energy levels and energy eigenfunctions using Frobenius method	Second Week	
15.	Quantum theory of hydrogen-like atoms: time independent Schrodinger equation in spherical polar coordinates;	Third Week	
16.	Separation of variables for the second order partial differential equation; angular momentum operator and quantum numbers;	Fourth Week	
17.	Radial wave functions from Frobenius method;	First Week	November
18.	Orbital angular momentum quantum numbers l and m; s, p, d, shells, Electron Angular Momentum	Second Week	
19.	Space Quantization, Electron Spin and Spin Angular Momentum, Larmor's Theorem.	Third Week	
20.	Spin Magnetic Moment. Stern-Gerlach Experiment. Zeeman Effect: Electron Magnetic Moment and Magnetic Energy, Gyromagnetic Ratio and Bohr Magneton	Fourth Week	
21.	Atoms in External Magnetic Fields: Zeeman Effect	First Week	December
22.	MTT	Second Week	
23.	MTT	Third Week	
24.	Normal and Anomalous Zeeman Effect.	Fourth Week	
25.	Pauli's Exclusion Principle. Symmetric and Antisymmetric Wave Functions. Periodic table	Second Week	February
26.	Fine structure. Spin orbit coupling. Spectral Notations for Atomic States. Total Angular Momentum.	Third Week	
27.	Vector Model. Spin-orbit coupling in atoms-L-S and J-J couplings	Fourth Week	
28.	Revision	First Week	March
29.	Revision	Second Week	
30.	Revision	Third Week	
31.	Revision	Fourth Week	

There will be class test at the end of each unit.

Course: Radiation Safety (PHYS307)

Lectures per Week: 2

Course Outcomes (CO):

After the completion of this course students should be able to;

CO-1. Understand the Basics of Atomic and Nuclear Physics.
CO-2. To learn Interaction of Radiation with matter: Types of Radiation.
CO-3. To study Radiation detection and monitoring devices.
CO-4. Get knowledge of Radiation safety management.
CO-5. Understand Application of nuclear techniques.

S.No.	Topic	Week	Month
1.	Basic concept of atomic structure; X rays characteristic and production; concept of bremsstrahlung and auger electron.	First Week	July
2.	The composition of nucleus and its properties, mass number, isotopes of element, spin, binding energy, stable and unstable isotopes.	Second Week	
3.	Law of radioactive decay, Mean life and half-life, basic concept of alpha, beta and gamma decay.	Third Week	
4.	Concept of cross section and kinematics of nuclear reactions, types of nuclear reaction, Fusion, fission.	Fourth Week	
5.	Alpha, Beta, Gamma and Neutron and their sources.	First Week	August
6.	Sealed and unsealed sources, Interaction of Photons – Photo electric effect, Compton Scattering, Pair Production, Linear and Mass Attenuation Coefficients	Second Week	
7.	Interaction of Charged Particles: Heavy charged particles - Beth-Bloch Formula, Scaling laws, Mass Stopping Power, Range, Straggling	Third Week	
8.	Channelling and Cherenkov radiation. Beta Particles-Collision and Radiation loss (Bremsstrahlung), Interaction of	Fourth Week	

	Neutrons- Collision, slowing down and Moderation.		
9.	Basic idea of different units of activity, KERMA.	First Week	September
10.	Exposure, absorbed dose, equivalent dose, effective dose, collective equivalent dose, Annual Limit of Intake (ALI) and derived Air Concentration (DAC).	Second Week	
11.	Radiation detection: Basic concept and working principle of gas detectors (Ionization Chambers, Proportional Counter	Third Week	
12.	Multi-Wire Proportional Counters (MWPC) and Geiger Muller Counter).	Fourth Week	
13.	Scintillation Detectors (Inorganic and Organic Scintillators).	First Week	October
14.	Solid States Detectors and Neutron Detectors, Thermo luminescent Dosimetry.	Second Week	
15.	Radiation safety management: Biological effects of ionizing radiation.	Third Week	
16.	Operational limits and basics of radiation hazards evaluation and control: radiation protection standards.	Fourth Week	
17.	International Commission on Radiological Protection (ICRP) principles, justification, optimization, limitation.	First Week	November
18.	Introduction of safety and risk management of radiation.	Second Week	
19.	Nuclear waste and disposal management.	Third Week	
20.	Brief idea about Accelerator driven Sub-critical system (ADS) for waste management.	Fourth Week	
21.	Application of nuclear techniques	First Week	December
22.	Application in medical science (e.g., MRI, PET, Projection Imaging Gamma Camera, radiation therapy)	Second Week	
23.	MTT	Third Week	
24.	MTT	Fourth Week	
25.	Archaeology, Art, Crime detection.	Second Week	February

26.	Mining and oil. Industrial Uses: Tracing, Gauging.	Third Week	
27.	Material Modification, Sterilization, Food preservation.	Fourth Week	
28.	Revision	First Week	March
29.	Revision	Second Week	
30.	Revision	Third Week	
31.	Revision	Fourth Week	

There will be class test at the end of each unit.

Course: Renewable Energy Sources and Energy Harvesting (PHYS310)

Lectures per Week: 2

Course Outcomes (CO):

After the completion of this course students should be able to;

CO-1. To study Fossil fuels and Alternate Sources of energy.

CO-2. To study Solar energy and its importance. CO-3. Know the Wind Energy harvesting, Ocean energy.

CO-4. Understand the harvesting of Geothermal Energy and hydro energy.

CO-5. To study Piezoelectric Energy harvesting and electromagnetic energy.

S.No.	Topic	Week	Month
1.	Fossil fuels and Nuclear Energy, their limitation	First Week	July
2.	Need of renewable energy, non-conventional energy sources	Second Week	
3.	An overview of developments in Offshore Wind Energy, Tidal Energy	Third Week	
4.	Wave energy systems, Ocean Thermal Energy Conversion.	Fourth Week	
5.	Solar energy, biomass, biochemical conversion.	First Week	August
6.	Biogas generation, geothermal energy tidal energy	Second Week	
7.	Hydroelectricity.	Third Week	
8.	Solar energy, its importance, storage of solar energy.	Fourth Week	
9.	Solar pond, non-convective solar pond, applications of solar pond and solar energy	First Week	September
10.	Solar water heater, flat plate collector.	Second Week	
11.	Solar distillation, solar cooker, solar green houses, solar cell, absorption air conditioning.	Third Week	

12.	Need and characteristics of photovoltaic (PV) systems.	Fourth Week	
13.	PV models and equivalent circuits, and sun tracking systems.	First Week	October
14.	Fundamentals of Wind energy	Second Week	
15.	Wind Turbines and different electrical machines in wind turbines	Third Week	
16.	Power electronic interfaces, and grid interconnection topologies.	Fourth Week	
17.	Ocean Energy Potential against Wind and Solar, Wave Characteristics and Statistics, Wave Energy Devices.	First Week	November
18.	Tide characteristics and Statistics, Tide Energy Technologies, Ocean Thermal Energy, Osmotic Power, Ocean Bio-mass	Second Week	
19.	Geothermal Resources, Geothermal Technologies	Third Week	
20.	Hydropower resources, hydropower technologies	Fourth Week	
21.	Environmental impact of hydro power sources.	First Week	December
22.	Introduction, Physics and characteristics of piezoelectric effect, materials and mathematical description of piezoelectricity	Second Week	
23.	MTT	Third Week	
24.	MTT	Fourth Week	
25.	Piezoelectric parameters and modelling piezoelectric generators, Piezoelectric energy harvesting applications, Human power.	Second Week	February
26.	Linear generators, physics mathematical models, recent applications, Carbon captured technologies.	Third Week	
27.	Cell, batteries, power consumption, Environmental issues and Renewable sources of energy, sustainability.	Fourth Week	
28.	Revision	First Week	March
29.	Revision	Second Week	
30.	Revision	Third Week	
31.	Revision	Fourth Week	

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