PROGRAMME STRUCTURE AND SYLLABUS

B.Sc. (Physics subject)

Department of Physics

School of Science

Uttarakhand Open University
Teenpani, Haldwani, Nainital - 263139
Uttarakhand

Name of the Programme: Bachelor of Science **Programme Code: BSC**

Programme Structure (Year wise)

First Year

S.N.	Course Name	Course Code	Marks			Credits	Minimum Counseling hours
			Th.	Ass.	Total		
1.	Mechanics	BSCPH101	40	10	50	03	9
2.	Electromagnetism	BSCPH102	40	10	50	03	9
3.	Oscillations and Waves	BSCPH103	40	10	50	03	9
4.	Practical Physics I	BSCPH104			50	03	9

Second Year

S.N.	Course Name	Course Code	Marks			Credits	Minimum Counseling hours
			Th.	Ass.	Total		
1.	Thermal and Statistical Physics	BSCPH201	40	10	50	03	9
2.	Optics	BSCPH202	40	10	50	03	9
3.	Elementary Solid State Physics	BSCPH203	40	10	50	03	9
4.	Practical Physics II	BSCPH204			50	03	9

Third Year

S.N.	Course Name	Course Code	Marks			Credits	Minimum Counseling hours
			Th.	Ass.	Total		
1	Elements of Quantum Mechanics	BSCPH301	40	10	50	03	9
2	Modern Physics	BSCPH302	40	10	50	03	9
3	Basic Electronics	BSCPH303	40	10	50	03	9
4	Practical Physics III	BSCPH304			50	03	9

Course 1: Mechanics

Course code: BSCPH101 **Credit: 3**

BLOCK 1 Vector Analysis

Unit –1: **Vector**: Types of vectors, vector representation, dot product and cross product scalar triple product and vector triple product

Unit –2: **Vector Calculus:** Differentiation of vector, Del operator, scalar and vector fields, gradient, divergence and curl

Unit –3: **Gauss, Stoke and Green's theorem**: Gauss divergence theorem, Stokes' theorem, Greens theorem

BLOCK 2 Mechanics of a Particle

Unit –4: **Newton's laws and Conservation principles:** Newton's laws of motion, principle of conservation of linear momentum

Unit –5: **Principles of conservation of energy and angular momentum**: Conservation of energy, principle of conservation of angular momentum

Unit –6: **Rotational motion**: Rotational motion, angular velocity, angular acceleration, angular momentum, torque

Unit –7: **Motion of Charged particle**: Motion of Charged particle in Crossed electrical and magnetic field

BLOCK 3 Dynamics of Rigid Bodies:

Unit –8: **Moment of inertia**: Equation of motion, angular momentum vector, Moment of inertia and radius of gyration Physical significance of MI, theorems of parallel and perpendicular axes, Rotational kinetic energy

Unit –9: **Formulation of moment of inertia**: Formulation and derivation of moment of inertia for some simple symmetric systems (rod, rectangular lamina, circular lamina, solid sphere, cylinder)

Unit –10: **Pendulums:** Compound pendulum, Kater's pendulum, and applications.

BLOCK 4 : Gravitation and Properties of matter

Unit –11: **Gravitation**: law of Gravitation, Gravitational field and potential, Gravitational potential energy

Unit –12: **Escape velocity and gravitational potential**: Escape velocity, Gravitational field, Gravitational potential and intensity due to thin uniform spherical shell and solid sphere of uniform density

Unit –13: **Conservative forces and inverse square law**: Conservative and non-conservative forces. Force as gradient of potential energy. Particle collisions. Centre of mass frame and laboratory frame, Inverse square law, Kepler's laws

Unit –14: **Elasticity and elastic constants:** Hook's law, elastic constants, relation between elastic constants.

Unit –15: **Torsion of cylinder and bending of beam**: Torsion of cylinder, bending of beam cantilever, shape of girder.

Course 2: Electricity and Magnetism

Course code: BSCPH102 **Credit: 3**

BLOCK 1 Electrostatics

Unit –1: **Electrostatics:** Quantization of charge and Millikan's oil-drop experiment, Coulomb's law application

Unit –2: **Electric field and Potential:** Intensity and potential, Gauss' theorem, simple applications,

Unit –3: **Electric field and Potential II:** Potential and field due to an arbitrary charge, long charged wire, sphere, disc, electric dipole, and energy stored in an electric field

BLOCK 2 Dielectric properties of matter

Unit –4: **Polarization:** Dielectric polarization and polarization charges, Gauss's law in dielectrics

Unit –5: **Dielectric:** Vectors D and E and their boundary conditions, capacitors filled with dielectrics.

Unit –6: **Dielectric Susceptibility** Dielectric Susceptibility and permittivity, Clausius-Mossotti relation, Langevin theory of polar dielectric

BLOCK 3: Magnetism

Unit –7: **Basic Magnetism:** Lorentz force, Bio-Saverts law, Magnetic force between current elements, Ampere's circuital law, Maxwell correction in Ampere's law

Unit –8: **Vector potential and Magnetic flux**: Curl and divergence of B, Vector potential, Magnetic flux, Calculation of B for circular and solenoidal currents. Torque on a current loop in a uniform magnetic field, Magnetic dipole
Unit –9: **Magnetic dipole**: Torque on a current loop in a uniform magnetic field, Magnetic dipole, Energy stored in a magnetic field, Ballistic galvanometer
Unit –10: **Magnetization:** Intensity of magnetization, relation between **B**, **H**, and **M,** illustration in the case of bar magnet,
Unit –11: **Magnetic susceptibility:** Magnetic susceptibility, dia, para and ferromagnetic materials, Curie's law. Hysteresis in a ferromagnetic material.

BLOCK 4: Electricity

Unit –12: **Steady Current:** Electric Current, Drift Velocity, Current density, equation of continuity, electric Resistivity and conductivity, Wiedemann-Frenz law.

Unit –13: **Alternative current**: Mean and r.m.s. values of current and emf with sinusoidal wave form, Reactance, impedance, phase-angle, power dissipation in AC circuit, power factor, vector diagram, series LR, CR and LCR circuits Resonance in a series LCR circuit, Q-factor, principle of ideal Transformer

Course 3: Oscillations and Waves
Course code: BSCPH103 **Credit: 3**

BLOCK 1 Simple Harmonic Motion:
Unit –1: **Simple Harmonic Motion I:** Basic Characteristics of Simple Harmonic Motion, Oscillations of a Spring-Mass System; Differential Equation of SHM and its Solution
Unit –2: **Simple Harmonic Motion II:** Phase of an oscillator executing SHM, Velocity and Acceleration, Transformation of Energy in Oscillating Systems, Kinetic and Potential Energies.
Unit–3: **Physical Systems and Pendulums**: Examples of Physical Systems Executing SHM: Simple Pendulum, Compound Pendulum, Torsional Pendulum.
Unit–4: **Superposition of harmonic oscillations**: LC circuit, principle of superposition, Superposition of two collinear harmonic oscillations of same/different frequencies, Oscillations in two dimensions
Unit–5: **Superposition of two mutually perpendicular harmonic oscillations**: Superposition of two mutually perpendicular harmonic oscillations of the same/different frequencies; Lissajous Figures.
BLOCK 2: Damped and Forced Oscillations:
Unit–6: **Damped Oscillations:** Differential equation of a damped oscillator and its solutions, heavy damping, critical damping, weak damping; characterising weak damping: logarithmic decrement; relaxation time, quality factor
Example of a weakly damped system - LCR circuit; differential equation of an undamped oscillator and its solution;
Unit–7: **Forced Oscillations and Resonance**: differential equation of a weakly damped forced harmonic oscillator and its solutions, steady state solution, resonance. Examples of forced vibrations and resonance, power absorbed by a forced oscillator, quality factor
BLOCK 3 Basic Concepts of Wave Motion:

Unit–8: **Wave Motion**: Formation of a Wave; Graphical Representation of Wave Motion, Relation between Wave Velocity, Frequency and Wavelength; Mathematical Description of Wave Motion:
Unit–9: **Phase, Energy and Intensity of wave**: Transported Phase and Phase Difference, Phase Velocity, Energy Transported by Progressive Waves, Intensity and the Inverse Square Law;
Unit–10: **One-dimensional Wave Equation**: One-dimensional Wave Equation Waves on a Stretched String, Waves in a Field, Waves in a Uniform Rod; Waves in Two and Three Dimensions;
Unit–11: **The Doppler Effect**: Source in Motion and Observer Stationary, Source Stationary and Observer in Motion, Source and Observer both in Motion; Shock Waves.
Unit –12: **Principle of Superposition and types of waves**: Principle of Superposition of Waves; Stationary Waves, Properties of stationary waves, Velocity of a Particle at any Point in a Stationary Wave, Harmonics in Stationary Waves.

Course 4: Practical Physics - I
Course code: BSCPH104 **Credit:3**

At least 12 experiments out of this list are to be performed by the student.

1. TO DETERMINE THE RESTORING FORCE PER UNIT EXTENSION OF A SPRING BY STATIC AND DYNAMICAL METHODS AND ALSO DETERMINE THE MASS OF THE SPRING.
2. TO DETERMINE THE COEFFICIENT OF DAMPING, RELAXATION TIME AND QUALITY FACTOR OF A DAMPED SIMPLE HARMONIC MOTION USING A SIMPLE PENDULUM.
3. TO DETERMINE THE YOUNG'S MODULUS, MODULUS OF RIGIDITY AND POISSON'S RATIO OF A GIVEN WIRE BY SEARLE'S DYNAMICAL METHOD.
4. TO DETERMINE THE MOMENT OF INERTIA OF A IRREGULAR BODY ABOUT AN AXIS PASSING THROUGH ITS CENTRE OF GRAVITY AND PERPENDICULAR TO ITS PLANE BY DYNAMICAL METHOD.
5. TO DETERMINE THE MOMENT OF INERTIA OF FLYWHEEL.
6. TO STUDY THE VARIATION OF 'T' WITH 'l' FOR A BAR PENDULUM AND THEN TO DETERMINE THE VALUE OF 'g' K and I IN THE LABORATORY.
7. TO DETERMINE THE VALUE OF 'g' BY MEANS OF A KATER'S PENDULUM.
8. TO CONVERT GALVANOMETER INTO AN AMMETER.
9. TO CONVERT GALVANOMETER INTO A VOLTMETER.
10. TO DETERMINE THE YOUNG'S MODULUS OF THE MATERIAL OF A GIVEN BEAM SUPPORTED ON TWO KNIFE-EDGES AND LOADED AT THE MIDDLE POINT.
11. TO STUDY THE RESONANCE IN SERIES LCR CIRCUIT WITH A SOURCE OF GIVEN FREQUENCY (AC MAINS).
12. STUDY OF PARALLEL AND PERPENDICULAR AXIS THEOREMS
13. STUDY OF AIR FLOW THROUGH A CAPILLARY.
14. TO DETERMINE THE MAGNETIC SUSCEPTIBILITY OF $NiSO_4$

Note: Some more experiments may be added in the list, depending on the requirement of student and availability of apparatus in the laboratory.

Course 5: Thermodynamics and Statistical Mechanics

Course code: BSCPH201 **Credit:3**

Block 1:- Basic concepts and Laws of thermodynamics

Unit 1: **Basic concepts:** Temperature, internal energy, Quasistatic process, isothermal and adiabatic process, zeroth law of thermodynamics

Unit 2: **First law of thermodynamics**: First law of thermodynamics: thermodynamic equilibrium, differential form of first law, Application of first law, Insufficiency of first law

unit 3 : **Second law of thermodynamics:** Reversible and irreversible process, work and heat energy, work done during isothermal and adiabatic process Heat engines, Carnot cycle, Carnot engine and its efficiency, Carnot theorem, Second law of thermodynamics, stem engine, internal combustion engine, petrol engine.

Unit 4: **Entropy:** Entropy, Physical concept of entropy, entropy change in reversible and irreversible process, principle of increase of entropy, Clausius theorem, temperature entropy TS diagram, entropy of perfect gas, Kelvin Scale of temperature, Absolute zero temperature, unattainability of absolute zero, Nernest theorem(third law of thermodynamics)

Block 2:- Thermodynamic Relationship, potentials and applications

Unit 5 : **Thermodynamic Relationship:** Extensive and intensive thermodynamic variables, Maxwell thermodynamic Relations: derivation and Applications, specific heat of a substance, relation between Cp and Cv, its relation, Clausius Clapeyron equation, energy equation, Joule Thomson effect and coefficient, Temperature inversion

Unit 6 : **Thermodynamic Potentials and applications:** Thermodynamic potentials U, H, F and G, relations of thermodynamic potentials and variables, TdS equations, stretching of wire, basic idea about phase transitions, cooling due to adiabatic magnetization, Approach to Absolute zero.

Block 3:- Black Body radiations and related laws

Unit 7: Black body radiation, Kirchoff's Law, energy distribution in Black Body radiation, Nearest example of Black Body

Unit 8: Wein's radiation law, Rayleigh Jeans law, Stefan Boltzmann Law and Wein's Displacement law, ultraviolet catastrophe

Unit 9: deduction of Planck's law of Black Body Radiation, deduction of Wein's law, Rayleigh law and wein's displacement law from Planck's law

BLOCK 4: Statistical basis

Unit –10: Probability and thermodynamical probability, Classical description in terms of phase space and quantum description in terms of wave functions

Unit –11: Hypothesis of equal *a priori* probability for microstates of an isolated system in equilibrium. Interactions between two systems – thermal, mechanical and diffusive

Unit –12: Statistical definition of temperature, pressure, entropy and chemical potential. Partition function of a system in thermal equilibrium with a heat bath

Unit –13: Gibbs' paradox. Identical particle and symmetry requirement, Derivation of MB, FD and BE statistics

Course 6: Optics

Course code: BSCPHY202 Credit:3

BLOCK 1 Geometrical optics

Unit –1: **Fermat's principle:** Fermat's principle and its application to deduce law of reflection and refraction, Gauss's general theory of image formation.

Unit –2: **Image formation**: Coaxial symmetrical system, cardinal points of an optical system, general relation

Unit –3: **Thick lens and lens combination**: Thick lens and lens combination, telescope.

BLOCK 2 Interference of light waves

Unit–4: **Interference:** Introduction to Interference of light, principle of superposition, Young's experiment, coherence, spatial and temporal coherence; intensity distribution, biprism and Fresnel's biprism

Unit –5: **Interference in thin film and Newton's rings** : Interference by division of amplitude, interference in thin film, wedge shaped film, Newton's rings in reflected and refracted light, determination of refractive index by Newton's rings experiment.

Unit –6: **Haidinger Fringes**: Haidinger Fringes, Fringes of equal inclination and equal thickness, Michelson's interferometer, Multiple beam interference – reflected and transmitted pattern, Fabry-Perot interferometer.

BLOCK3 Diffraction of light waves

Unit –7: **Diffraction: T**ypes of diffraction, Fresnel and Fraunhofer class, Fresnel's half period zones; explanation of rectilinear propagation of light; zone plate, comparison of zone plate with lens, wave front, diffraction at a straight edge.

Unit –8: **Fraunhofer diffraction**: Condition for Fraunhofer diffraction, Fraunhofer diffraction due to a single slit, Fraunhofer diffraction due to double slit, Fraunhofer diffraction at circular aperture (qualitative), Plane diffraction grating (transmission), diffraction due to a grating of N parallel slits, Maximum number of order available in a grating, missing orders.

Unit –9: **Resolution and resolving power**: Introduction, resolving power, Rayleigh criterion of resolution; resolving power of transmission grating, resolving power of prism, resolving power of telescope, resolving power of microscope.

BLOCK 4: Polarization of light waves

Unit –10: **Polarization:** Introduction, Concept of plane polarized light, circularly and elliptically polarized light, Malus law, Brewster law.

Unit –11: **Double refraction** Introduction, double refraction, Huygen's construction for uniaxial crystals; polaroids and their uses.

Unit –12: **Production of Polarized light**: Introduction, Production and analysis of plane, circularly and elliptically polarized light by retardation plates and rotatory polarization.

Unit –13: O**ptical activity**: Introduction, rotatory polarization, optical activity; Fresnel's explanation of optical activity; Biquartz and half shade polarimeter

BLOCK 5: Optical Instruments and Aberration in images:

Unit –14: **Optical Instruments:** Introduction, Human eye, field of view, need of multiple lens eyepieces, Ramsden's eyepiece, Huygen's eyepiece, Gaussian eyepiece, comparisons of eye pieces, Astronomical refracting telescope, Spectrometer, electron microscope.

Unit –15: **Aberration in images**: Introduction, Aberration in images, chromatic aberration of lens, achromatic combination of lenses, monochromatic aberration, spherical mirrors, Schmidt corrector plate, oil immersion lens.

Course 7: Elementary Solid State Physics

Course code: BSCPHY203 **Credit: 3**

BLOCK 1 Crystal Structure

Unit –1: **Crystal structure :** Crystalline and amorphous solids, single crystal and poly crystal, elementary ideas about crystal structure, lattice and bases, unit cell, Bravais lattices, s.c., f.c.c. and b.c.c. lattices, characteristics of lattices cell, some crystal structures.

Unit –2: **Crystal symmetry:** Miller indices, lattice planes, spacing of planes in crystal lattices, symmetry operation, translational symmetry, basic idea about liquid crystal.

Unit –3: **Reciprocal lattice** : X ray diffraction, Bragg equations, Determination of crystal structure with X-rays, Laue and Powder method, Reciprocal lattice system, Ewald's construction.

Unit –4: **Crystal bonding** : Crystal bonding, ionic crystal, potential and lattice energy of ionic crystal, Madelung constant, covalent bonding, Van der wall bonding, Lenard Jones potential, hydrogen bond, metallic bond.

BLOCK 2 Band theory of solids

Unit –5: **Free Electron theory :**Free electron theory of metals, Lorentz Drude theory, electrical conductivity, thermal conductivity. Wiedemann-Franz law

Unit –6: **Band theory of solids :** Band formation in solids, Band structure in conductors, Periodic potential and Bloch theorem, Kronig-Penny model, origin of band gap

Unit –7: **Semiconductors :** Semiconductors, effect of impurity on semiconductor, Fermi level, Electron and hole concentration, drift current, mobility and conductivity, Effective mass, Hall effect.

BLOCK3 Lattice vibrations and Specific heat

Unit –8: **Lattice vibrations:** Elastic and atomic force constants, quantization of lattice vibrations, Dynamics of a chain of monoatomic lattice, optical and acoustic modes, dispersion relation, concept of phonon, comparison of phonon and photons.

Unit –9: **Specific heat:** Specific heat of solids, Dulong and Petit's law, lattice heat capacity, Einstein theory of specific heat, Debye's theory of specific heat, Density of state , lattice thrmal conductivity, normal and umklapp processes, paramagnetism of free electrons.

BLOCK 4: Dielectric and Magnetic properties of materials

Unit –10: **Dielectric properties:** Electronic, ionic and dipolar polarizability, local fields, induced and oriented polarization, molecular field in a dielectric; Clausius-Mosotti relation.

Unit –11: **Magnetic properties:** magnetization, magnetic materials, Dia, para and ferro-magnetic properties of solids, magnetic moment, spin angular moment, Langevin's theory of diamagnetism and paramagnetism, Quantum theory of paramagnetism, Curie's law,

Unit –12: **Ferromagnetism**: Ferromagnetism, hysteresis and hysteresis loss, permanent magnet, spontaneous magnetization and domain structure, Weiss theory of ferromagnetism, anti-Ferromagnetism, ferrites, use of ferrites.

BLOCK 5: Superconductivity

Unit –13: I**ntroduction**: (Kamerlingh-Onnes experiment), effect of magnetic field, Type-I and type-II superconductors, Isotope effect, Meissner effect, Heat capacity, Energy gap, Quantum theory of superconductor, BCS theory, Basic Ideas about High-Tc superconductors, application.

Course 8: Practical Physics - II
Course code: BSCPH204 **Credit: 3**

At least 12 experiments out of this list are to be performed by the student.

1. Study of Malus law.
2. To draw the characteristics of a photo electric cell.
3. To determine the value of Planck's constant by a photo cell.
4. To determine the focal length of the combination of two lenses separated by a distance with the help of a nodal slide and to verify the formula $1/f = 1/f_1 + 1/f_2 – x/f_1f_2$.
5. To locate the cardinal points of a system of two thin convergent lenses separated by a distance and then to verify the formulae $L_1H_1 = + xF/f_2$ and $L_2H_2 = - xF/f_1$.
6. To determine the wavelength of sodium light by Newton's rings method.
7. To determine the wavelength of prominent lines of mercury by plane diffraction grating.
8. To verify Hartmann's formula using a prism spectrometer.
9. To determine the refractive index of a material of the prism for the given colours of mercury light with the help of a spectrometer.
10. To study the variation of refractive index of the material of the prism with wavelength and to verify Cauchy's dispersion formula.
11. To determine the dispersive power of the material of the prism for violet and yellow colours of mercury light with the help of a spectrometer.
12. To determine the dispersive power of a plane transmission diffraction grating.
13. To verify Stefan's law.
14. Thermal conductivity of a bad conductor by Lee's method.
15. Mechanical equivalent of heat by Searle's method.
16. Thermal conductivity of good conductor by Searle's method.
17. Study of Platinum resistance thermometer.
18. Newton's law of cooling.

Note: Some more experiments may be added in the list, depending on the requirement of student and availability of apparatus in the laboratory.

Course 9: Elements of Quantum mechanics and Relativity
Course code: BSCPH301 **Credit: 3**

BLOCK 1 Basic quantum mechanics

Unit –1: **Origin of quantum mechanics I (classical theories)**: Introduction, failure of classical mechanics, Black body radiation, Rayleigh Jean's law, Plank's radiation law, Einstein's explanation of Black body radiation, Photoelectric effect, Einstein's explanation for Photoelectric effect, Compton Effect, Experimental verification of Compton Effect, Classical theory of heat capacity of solids, Einstein's Theory of specific heat of solids, Debye Theory of specific heat of solids,

Unit –2: **Origin of quantum mechanics II (classical theories)**: Atomic models, Bohr atomic model and theory of hydrogen atom, atomic spectra of hydrogen atom, binding energy of electron, merits and limitation of Bohr atomic model, Franck Hertz experiment, Wilson-Sommerfeld quantization rule, Shortcoming of classical theories and old quantum mechanics, Foundation of quantum mechanics or wave mechanics.

Unit –3: **Basics of wave mechanics**: Duel nature of light and matter, de Broglie hypothesis, experimental evidence of matter wave (Davisson-Germer experiment), Electron double-slit experiment, Group and phase velocities, wave packet.

Unit –4: **Heisenberg's uncertainty principle**: Heisenberg's uncertainty principle, position momentum uncertainty, time energy uncertainity, proof of uncertainty principle, applications with illustrations. Gaussian wave packet.

BLOCK 2: Schrodinger Wave Equation and Application

Unit –6: **Schrodinger Wave Equation:** Schrodinger time dependent and independent equation, wave function, physical significance of wave function, Probabilistic interpretation, normalized and orthogonal wave function, solution of Schrodinger wave equation, operators, eigen function and eigen value, expectation value, normalization and normalization factor, probability density.

Unit –7: **Operators:** Definition, Momentum, energy and angular momentum operators, Commutation relations between operators, Ehrenfest theorem

Unit –8: **Particle in a box**: Free particle, particle in a box, energy levels, wave function and probability density, parity, potential step, One dimensional potential barrier, application of potential (explanation of alpha decay)

Unit –9: **Linear harmonic oscillator:** Linear harmonic oscillator

Unit –10: **Hydrogen atom:** Angular momentum, quantization of Angular momentum, spherical symmetry , Schrödinger wave equation for spherical system, hydrogen atom, energy eigen value of H atom, wave function of H atom, normal state of H atom.

BLOCK 3: Relativity

Unit –11: **Frame of reference:** Inertial and non inertial frame of reference, Michelson-Morley experiment and its outcome, Lorentz Transformations

Unit –12: S**pecial theory of relativity:** Postulates of special theory of relativity length contraction, time dilation, relativistic transformation of velocity, Velocity dependence of mass, equivalence of mass and energy, Relativistic Doppler Effect.

Course 10: Modern Physics
Course code: BSCPH302 **Credit: 3**

BLOCK 1 Atomic Models
Unit –1: specific charge e/m, Thomson model, Rutherford's atomic model,
Unit –2: Bohr model and spectra of hydrogen atom, fine structure and shortcoming,
Unit –3: Stern Gerlach experiment, Bohr megneton, Larmer's precession,
Unit –4: Magnetic moment of the electron, Lande g factor. Vector model – space quantization

BLOCK 2 Optical Spectra
Unit –5: Pauli Exclusion Principle, spectroscopic terms of many electron atoms in the ground state, spectral notations.
Unit –6: L-S, J-J coupling, selection rules and intensity rules
Unit –7: Explanation of fine structure of sodium D line, Normal Zeeman effect
Unit –8: X ray spectra, characteristic and continuous, Moseley's rule

BLOCK3 Laser Physics
Unit –9: Spontaneous and induced emission, metastable states, Einstein's A and B coefficients
Unit –10: spatial and temporal coherence, optical pumping, Population inversion, laser action.
Unit –11: Ruby and He-Ne laser, applications of Laser.

BLOCK 4: Nuclear physics
Unit –12: Nuclear mass, charge, size, binding energy, spin and magnetic moment. Isobars, isotopes and isotones;
Unit –13: Nature of forces between nucleons, nuclear stability and nuclear binding, the liquid drop model (descriptive) and the Bethe-Weizsacker mass formula.
Unit –14: Nuclear reaction, Conservation principles in nuclear reactions. Q-values and thresholds, examples of different types of reactions and their characteristics
Unit –15: Nuclear fission and fusion.
Unit –16: Four basic interactions in nature and their relative strengths, examples of different types of interactions.
Unit –17: Classifications of elementary particles, hadrons and leptons, baryons and mesons, elementary ideas about quark structure of hadrons.

Course 11: Basic Electronics
Course code: BSCPH304 **Credit:3**

BLOCK 1 Network theorem and solid state device
Unit –1: Network theorems, Superposition, Thevenins theorem, Norton's maximum power
Unit –2: Low pass and high pass filters, four terminal networks, CRT
Unit –3: P-N junction diode, Zener diode, tunnel diode, photo diode, LED
Unit –4 Transistors operation, characteristic curves, common base, common collector, common emitter configuration, α and β and their interrelations.

BLOCK 2 Rectifier and Power supply
Unit –6: Half wave full wave and bridge rectifier.
Unit –7: Filter circuits, L- section, C- section and π section
Unit –8: Unregulated power supply, voltage regulated power supply, Zener diode as power regulation.

BLOCK3 Applications
Unit –9: FET, MOSFETS
Unit –5: Single stage CE amplifier, approximate expressions of current and voltage gain with the help of 'Load Line'.
Unit –10: R.C. Coupled transistor amplifier, noise and distortion in amplifier
Unit –11: Feedback amplifier, classification, negative feedback and its advantages.
Unit –12: Oscillators and multivibrators, Schmitt trigger.

BLOCK 4: Digital Electronics
Unit –13: Binary systems, binary numbers, Decimal to binary and reverse conversions; binary addition and subtraction
Unit –14: Hexa decimal, octal system and interconnection, BCD, GREY code.
Unit –15: Logic gates, OR, AND, NOT gates, truth tables. Statement of de Morgan's theorem, NOR and NAND universal gates
Unit –16: simplifying Boolean expressions; arithmetic circuits (adders, subtractor)

Course 12: Practical Physics - III
Course code: BSCPH305 **Credit:3**

At least 12 experiments out of this list are to be performed by the student.

1. To plot the characteristics of a Zener diode.
2. To plot output characteristics of FET and measure pinch off voltage.
3. To study the logic gates.
4. To draw the characteristics of PN junction diode.
5. To draw output characteristics of NPN transistor.
6. To draw output characteristics of PNP transistor.
7. To draw the characteristics of a vacuum diode valve.
8. To measure e/m by Helical method.
9. To verify Child-Langmuir's law of space charge limited current using a diode valve.
10. To verify Thevenin's theorem.
11. To draw characteristics of a triode valve.
12. To draw characteristics of a pentode valve.
13. To draw characteristics of a tetrode valve.
14. To draw characteristics of a photoelectric cell.
15. To determine the value of Planck's constant by a photo cell.
16. To find out the value of energy band gap in PN junction diode.

Note: Some more experiments may be added in the list, depending on the requirement of student and availability of apparatus in the laboratory.