2022-2023

Title	Syllabus Distribution
Session	2022-23 (Odd Semester)
Department	B.Sc General in Physics
Institution Name	Hiralal Bhakat College, Nalhati, Birbhum, W.B.
Coordinator	Md Ashik Mondal, SACT in Physics

Details of Courses of B.Sc. General under CBCS

Sl.	Course	Credit		Marks
1.	Core Course (12 Papers) 4 core papers each in 3 disciplines of choice	Theory+Practical 12×(4+2)=72	Theory+Tuitorial 12×(5+1)=72	12×75=900
2.	Elective Course DSE (6 Papers)	6×(4+2)=36	6×(5+1)=36	6×75=450
3	Ability Enhancement Core Course (AECC) AECC-1 (ENVS) AECC-2 (English/MIL)	 4×1=4 2×1=2	 4×1=4 2×1=2	 100 50
4.	SEC (4 Papers)	4×2=8	4×2=8	4×50=200
	Total Credit:	122	122	1700

B.Sc. PHYSICS General Course Structure

Semester	Course Course (CC)	Discipline Specific Elective (DSE)	Ability Enhancement Course	
			AECC (2)	SEC(4)
I	CC1A (Mathematics) CC2A (Physics) CC3A (Computer Sc.)		AECC-1	
II	CC1B (Mathematics) CC2B (Physics) CC3B (Computer Sc.)		AECC-2	
III	CC1C (Mathematics) CC2C (Physics) CC3C (Computer Sc.)			SEC-1 (Mathematics) or SEC-1 (Computer Sc.)
IV	CC1D (Mathematics) CC2D (Physics) CC3D (Computer Sc.)			SEC-2 (Mathematics) or SEC-2 (Computer Sc.)
V		DSE1A (Mathematics) DSE2A (Physics) DSE3A (Computer Sc.)		SEC-3 (Computer Science) or SEC-3 (Physics)
VI		DSE1B (Mathematics) DSE2B (Physics) DSE3B (Computer Sc.)		SEC-4 (Computer Science) or SEC-4 (Physics)

Semester-I

CoreCourse (CC 2A): MECHANICS

Syllabus	Number of Lecture	Course	Name of Teacher
Vectors: Vector algebra, Scalar and vector products, Derivatives of a vector with respect to a parameter.	**4L**	CC	Md Ashik Mondal
Ordinary Differential Equations: 1 storder homogeneous differential equations. 2 nd order homogeneous differential equations with constant coefficients.	**6L**		
Laws of Motion: Frames of reference. Newton's Laws of motion. Dynamics of a system of particles. Centre of Mass.	**10L**		
Momentum and Energy: Conservation of momentum. Work and energy. Conservation of energy. Motion of rockets.	**6L**		
Gravitation: Newton's 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 (statement only). Satellite in circular orbit and applications. Geosynchronous orbits. Weightlessness. Basic idea of global positioning system (GPS)	**8L**		
RotationalMotion: Angular velocity and angular momentum. Torque. Conservation of angular momentum.	**5L**		
Oscillations: Simple harmonic motion. Differential equation of SHM and its solutions. Kinetic and Potential Energy, Total Energy and their time averages. Damped oscillations.	**6L**		
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 - Determination of Rigidity modulus by static torsion - Torsional pendulum- Determination of Rigidity modulus and moment of inertia - by Searles methodσq, η and	**8L**		
Special Theory of Relativity: Constancy of speed of light. Postulates of Special Theory of Relativity. Length contraction. Time dilation. Relativistic addition of velocities.	**7L**		
1. Measurements of length (or diameter) using vernier caliper, screw gauge and travelling microscope. 2. To determine the Moment of Inertia of a Flywheel/ regular shaped objects. 3. To determine Young's Modulus by flexure method. 4. To determine the Young's Modulus of a Wire by Optical Lever Method. 5. To determine the Modulus of Rigidity of a wire by Maxwell's needle / dynamical method. 6. To determine the Elastic Constants of a Wire by Searle's method. 7. To determine g by Bar/Kater's Pendulum. 8. To determine the coefficient of viscosity by Poiseuille's method.		**Practical**	Md Ashik Mondal

Reference Books:

1. Advanced Practical Physics for students, B.L.Flint and H.T.Worsnop,1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4thEdition, reprinted 1985, Heinemann Educational Publishers.
3. Engineering Practical Physics, S.Panigrahi & B.Mallick, 2015, Cengage Learning India Pvt. Ltd.
4. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11thEdition, 2011, Kitab Mahal, New Delhi.

Semester - II

Semester-III

CoreCourse (CC 2C) THERMAL PHYSICS AND STATISTICAL MECHANICS

Syllabus	Number of Lecture	Course	Name of Teacher
Thermodynamic Description of system: Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between CP & CV, Work Done during Isothermal and Adiabatic Processes, Compressibility & Expansion Coefficient, Reversible & irreversible processes, Second law & Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero	**22 L**	CC	**Md Ashik mondal**
Thermodynamic Potentials: Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations & applications - Joule-Thompson Effect, Clausius-Clapeyron Equation, Expression for (CP – CV), CP/CV, TdS equations. .	**10 L**		
Kinetic Theory of Gases: Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases.	**10L**		
Theory of Radiation: Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution law, Rayleigh-Jeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law.	**6L**		
Statistical Mechanics: Phase space, Macro state and Micro state, Entropy and Thermodynamic probability, Maxwell-Boltzmann law - distribution of velocity - Quantum statistics - Fermi-Dirac distribution law - electron gas - Bose-Einstein Distribution law - photon gas - comparison of three statistics.	**12L**		
1. Measurement of Planck's constant using black body radiation. 2. To determine Stefan's Constant. 3. To determine the coefficient of thermal conductivity of a bad conductor by Lee and Charlton's disc method. 4. To determine the temperature co-efficient of resistance by Platinum resistance thermometer. 5. To study the variation of thermo emf across two junctions of a thermocouple with temperature. 6. To determine the coefficient of linear expansion by optical lever method. 7. To determine the pressure coefficient of air by constant volume method. 8. To determine the coefficient of linear expansion by travelling microscope.		**Practical**	Md Ashik Mondal

Syllabus	Number of Lecture	Course	Name of Teacher

Books Recommended:

1. Advanced Practical Physics for students, B.L.Flint & H.T.Worsnop, 1971, Asia Publishing House.
2. Advanced level Physics Practicals, Michael Nelson and Jon M. Ogborn, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, InduPrakash and Ramakrishna, 11thEdition, 2011,Kitab Mahal, New Delhi.
4. A Laboratory Manual of Physics for Undergraduate Classes, D.P. Khandelwal, 1985,Vani Publication.

Semester-V

DSE 2A : ELEMENTS OF MODERN PHYSICS

Introduction to Java: Features of Java, JDK Environment.Object Oriented Programming Concept Overview of Programming, Paradigm, Classes, Abstraction, Encapsulation, Inheritance, Polymorphism, Difference Planck's quantum, Planck's constant and light as a collection of photons; Photo-electric effect and Compton scattering. De Broglie wavelength and matter waves; Davisson – Germer experiment. (8Lectures) Problems with Rutherford model-instability of atoms and observation of discrete atomic spectra; Bohr's quantization rule and atomic stability; calculation of energy levels for hydrogen like atoms and their spectra. (4Lectures) Position measurement- gamma ray microscope thought experiment; Wave-particle duality, Heisenberg uncertainty principle- impossibility of a particle following a trajectory; Estimating minimum energy of a confined particle using uncertainty principle; Energy-time uncertainty principle.	**16 L**	DSE	**Md Ashik Mondal**
Two slit interference experiment with photons, atoms and particles;linear super position principle as a consequence; Matter waves and wave amplitude; Schrodinger equation for non- relativistic particles; Momentum and Energy operators; stationary states; physical interpretation of wavefunction, probabilities and normalization; Probability and probability current densities in one dimension. (11Lectur	**11 L**		
One dimensional infinitely rigid box- energy eigenvalues and eigenfunctions, normalization; Quantum dot as an example; Quantum mechanical scattering and tunnelling in one dimension - across a step potential and across a rectangular potential barrier. (12Lectures) Size and structure of atomic nucleus and its relation with atomic weight; Impossibility of an electron being in the nucleus as a consequence of the uncertainty principle. Nature of nuclear force, NZ graph, semi-empirical mass formula and binding energy. .	**18L**		
Radioactivity: stability of nucleus; Law of radioactive decay; Mean life & decayβ decay; αhalf-life; -ray emission. (11Lectures)γ- energy released, spectrum and Pauli's prediction of neutrino; Fission and fusion-mass deficit, relativity and generation of energy; Fission-nature of fragments and emission of neutrons. Nuclear reactor: slow neutrons interacting with Uranium-235; Fusion and thermonuclear reactions. (	**15 L**		
1. To determine value of Boltzmann constant using V-I characteristic of PN diode. 2. To determine work function of material of filament of directly heated vacuum diode. 3. To determine value of Planck's constant using LEDs of at least 4 different colours. 4. To determine the excitation potential of mercury/argon by Franck-Hertz experiment. 5. To determine the wavelength of H-alpha emission line of Hydrogen atom. 6. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light. 7. To determine the value of e/m by magnetic focusing. 8. To determine the band gap by measuring the resistance of a thermistor at different temperature.		**Practical**	Md Ashik Mondal

SEC-3: : COMPUTATIONAL PHYSICS

Syllabus	Number of Lecture	Course	Name of Teacher

Introduction: Importance of computers in Physics, paradigm for solving physics problems for solution. Usage of linux as an Editor. Algorithms and Flowcharts: Algorithm: Definition, properties and development. Flowchart: Concept of flowchart, symbols, guidelines, types. Examples: Cartesian to Spherical Polar Coordinates, Roots of Quadratic Equation, Sum of two matrices, Sum and Product of a finite series, calculation of sin (x) as a series, algorithm for plotting (1) lissajous figures and (2) trajectory of a projectile thrown at an angle with the horizontal. (4Lectures)	**16 L**	DSE	**Md Ashik Mondal**
Scientific Programming: Some fundamental Linux Commands (Internal and External commands). Development of FORTRAN, Basic elements of FORTRAN:CharacterSet, Constants and their types, Variables and their types, Keywords, Variable Declaration and concept of instruction and program. Operators: Arithmetic, Relational, Logical and Assignment Operators. Expressions: Arithmetic, Relational, Logical, Character and Assignment Expressions. Fortran Statements: I/O Statements (unformatted/formatted), Executable and Non-Executable Statements, Layout of Fortran Program, Format of writing Program and concept of coding, Initialization and Replacement Logic. Examples from physics problems. (5Lectures	**11 L**		
Control Statements: Types of Logic (Sequential, Selection, Repetition), Branching Statements (Logical IF, Arithmetic IF, Block IF, Nested Block IF, SELECT CASE and ELSE IF Ladder statements), Looping Statements (DO-CONTINUE, DO-ENDDO, DO-WHILE, Implied and Nested DO Loops), Jumping Statements (Unconditional GOTO, Computed GOTO, Assigned GOTO) Subscripted Variables (Arrays: Types of Arrays, DIMENSION Statement, Reading and Writing Arrays), Functions and Subroutines (Arithmetic Statement Function, Function Subprogram and Subroutine), RETURN, CALL, COMMON and EQUIVALENCE Statements), Structure, Disk I/O Statements, openafile, writing in a file, reading from a file. Examples from physics problems.	**18L**		

Signature,

Coordinator
Science Wing
Hiralal Bhakat College

Head
Department of Physics
Hiralal Bhakat College
Nalhati, Birbhum

Principal
HiralalBhakat College
Nalhati, Birbhum.

Principal
Hiralal Bhakat College
Nalhati, Birbhum

HIRALAL BHAKAT COLLEGE Estd-1986 W.B NALHATI, BIRBHUM