

Modules of Classes and Examinations, Odd Semester - July to Dec. (2023-'24)

CCFUP 3 Years Degree in PHYSICS Hiralal Bhakat College

Semester-I

Course Type: Major

Course No.: I

Course Title: MATHEMATICAL PHYSICS-I

Course Code: PHYS 1011

Evaluation process is divided into three (3) components, viz. **C1, C2, and C3.**

Total Marks: **75** (10+5+60), Credits: 4, Lecture Hours: 60

10 Marks for Internal Assessment (will be organized by the College in general and Department in Particular), that is **C1**. 10 Marks will be evaluated through **Class Test** or Assignment or Seminar. Appearance in **C1** is mandatory.

Marks division of Class Test will be 10 or **5+5** or 2+2+2+2+2.

Tentative **Date** and **Time** of Class Test or Assignment or Seminar: During the end of the 10th week of the semester when approximately 60% of the syllabus of course is to be completed.

5 Marks for Attendance that is **C2**.

Attendance: 50% & above but below 60% - 2 Marks

Attendance: 60% & above but below 75% - 3 Marks

Attendance: 75% & above but below 90% - 4 Marks

Attendance: 90% & Above - 5 Marks

60 Marks for Semester-end-Examination (will be organized by University), that is **C3**.

Syllabus: Whole

Duration: Two Hours

Question Pattern:

- Answer 5 questions out of 8 carrying 02 marks each = $5 \times 02 = 10$ marks
- Answer 5 questions out of 7 carrying 03 marks each = $5 \times 03 = 15$ marks
- Answer 03 questions out of 05 carrying 5 marks each = $03 \times 5 = 15$ marks
- Practical (Mechanics) = 20 Marks

Laboratory Note Book: 05 Marks

Viva- voce: 05 Marks

Experiment: 40 Marks (This 40 marks will be transformed into 10 Marks)

Topic List

Unit-I: CALCULAS

Sl. No.	Topic	Lecture Hours	Name of Teacher(s)
1	Recapitulation: Limits, Continuity, Average and instantaneous quantities, Differentiation. Plotting functions. Intuitive ideas of continuous, differentiable etc. functions and plotting of curves. Approximation: Taylor and binomial series (statements only).	3	Md Ashik Mondal
2	First Order and Second Order Differential equations: First Order Differential Equations and Integrating Factor. Homogeneous Equations with constant coefficients. Wronskian and general solution. Statement of the existence and the Uniqueness theorem for Initial Value Problems. Particular Integral.	9	Md Ashik Mondal
3	Calculus of functions of more than one variable: Partial derivatives, Exact and inexact differentials.	6	Md Ashik Mondal

Unit-II: VECTOR CALCULAS

Sl. No.	Topic	Lecture Hours	Name of Teacher(s)
1	Recapitulation of vectors: Properties of vectors under rotations. Scalar product and its invariance under rotations. Vector product, Scalar triple product and their interpretation in terms of area and volume respectively. Scalar and Vector fields.	5	Md Ashik Mondal
2	Vector Differentiation: Directional derivatives and normal derivative. Gradient of a scalar field and its geometrical interpretation. Divergence and curl of a vector field. Del and Laplacian operators. Vector identities.	6	Md Ashik Mondal
3	Vector Integration: Ordinary integrals of vectors, Multiple integrals, Jacobian. Notion of an infinitesimal line, surface and volume elements. Line, surface and volume integrals of vector fields. Flux of a vector field, Gauss' divergence theorem. Green's and Stokes Theorems and their applications (no rigorous proofs).	10	Md Ashik Mondal
4	Orthogonal Curvilinear Coordinates: Derivation of Gradient, Divergence, Curl and Laplacian in Cartesian, Spherical and Cylindrical Coordinate Systems.	6	Md Ashik Mondal

Semester-I

Course Type: Skill Enhancement Course (SEC)

Course No.: I

Course Title: RENEWABLE ENERGY AND ENERGY HARVESTING

Course Code: PHYS1051

Evaluation process is divided into three (3) components, viz. C1, C2, and C3.

Total Marks: **50** (10+40), Credits: 3, Lecture Hours: 45

10 Marks for Internal Assessment (will be organized by the College in general and Department in Particular), that is **C1**. 10 Marks will be evaluated through **Class Test** or Assignment or Seminar. Appearance in C1 is mandatory.

Marks division of Class Test will be 10 or **5+5** or 2+2+2+2+2.

Tentative **Date** and **Time** of Class Test or Assignment or Seminar: During the end of the 10th week of the semester when approximately 60% of the syllabus of course is to be completed.

C2 is not applicable for SEC.

40 Marks for Semester-end-Examination (will be organized by University) that is **C3**.

Syllabus: Whole

Duration: Two Hours

Question Pattern:

- Answer 5 questions out of 8 carrying 02 marks each = $5 \times 02 = 10$ marks
- Answer 5 questions out of 7 carrying 03 marks each = $5 \times 03 = 15$ marks
- Answer 03 questions out of 05 carrying 5 marks each = $03 \times 5 = 15$ marks

Topic List

Sl. No.	Topic	Lecture Hours	Name of Teacher(s)
1	Fossil Fuels and Alternate Sources of Energy:	8	Md Ashik Mondal
2	Solar energy:	8	Md Ashik Mondal
3	Wind Energy harvesting:	5	Md Ashik Mondal
4	Ocean Energy:	5	Md Ashik Mondal
5	Geothermal Energy:	4	Md Ashik Mondal
6	Hydro Energy:	5	Md Ashik Mondal
7	Piezoelectric Energy harvesting:	5	Md Ashik Mondal
8	Electromagnetic Energy Harvesting:	5	Md Ashik Mondal

Modules of Classes and Examinations, 2021-22

B.Sc. (GENERAL) IN PHYSICS

Semester-III

Hiralal Bhakat College, Nalhati

Core Course 2C : Thermal physics and Statistical physics

- Total 75 Marks
- 40 Marks for Semester-end-Examination[#] (will be organized by University)
- 20 Marks for practical (will be organized by College in general and Department in Particular)
- 10+5=15 Marks for Internal Assessment (will be organized by College in general and Department in Particular)
- 10 Marks for Class Test/ Assignment/ Seminar
- 5 Marks for Attendance
 - Attendance: 50% & above but below 60% - 2 Marks
 - Attendance: 60% & above but below 75% - 3 Marks
 - Attendance: 75% & above but below 90% - 4 Marks
 - Attendance: 90% & Above - 5 Marks

Internal Assessment	Component 1 (C ₁)	Component 2 (C ₂)
Weightage	5 Marks	1. 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. 2. 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. 3. 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.
Number of Questions	5	
Date	To be announced	
Time	To be announced	
Syllabus	1. Laws of Thermodynamics: 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. 2. 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.	
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Name of Teacher(s)	Md Ashik	Md Ashik
Number of Classes	62 (Tentative)	125 (Tentative)

Component 2:

- 40Marks for Semester-end-Examination (will be organized by University)
- Answer 5 questions out of 8 carrying 02 marks each = 5 x 02 = 10 marks
- Answer 5 questions out of 7 carrying 03 marks each = 5 x 03 = 15 marks
- Answer 03 questions out of 05 carrying 5 marks each = 03x 5 = 15 marks
- Whole Syllabus of CC 2C

- Practical (Statistical Methods in Geography) = 20 Marks
Laboratory Note Book: 05 Marks
Viva- voce: 05 Marks
Experiment: 40 Marks (This 40 marks will be transformed into 10 Marks)

- A project File (Laboratory Note Book), comprising one exercise each is to be submitted.

Modules of Classes and Examinations, 2021-22

B.Sc. (General) in Physics

Semester-V

Hiralal Bhakat College, Nalhati

DSE 2A

ELEMENT OF MORDERN PHYSICS

- Total 75 Marks
- 40 Marks for Semester-end-Examination[#] (will be organized by University)
- 20 Marks for practical (will be organized by College in general and Department in Particular)
- 10+5=15 Marks for Internal Assessment (will be organized by College in general and Department in Particular)
- 10 Marks for Class Test/ Assignment/ Seminar
- 5 Marks for Attendance
Attendance: 50% & above but below 60% - 2 Marks

Attendance: 60% & above but below 75% - 3 Marks

Attendance: 75% & above but below 90% - 4 Marks

Attendance: 90% & Above - 5 Marks

Internal Assessment	Component 1 (C ₁)	Component 2 (C ₂)
Number of Questions	5	<p>1. 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.</p> <p>2. 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.</p> <p>4. 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.</p> <p>5. 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.</p> <p>6. 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.</p> <p>7.. Radioactivity: stability of nucleus; Law of radioactive decay; Mean life & decay β decay; α half-life; γ-ray emission. energy released, spectrum and Pauli's prediction of neutrino; Fission and fusion-mass</p>
Date	To be announced	
Time	To be announced	
Syllabus Time	<p>1. 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.</p> <p>2. 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.</p> <p>3. 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.</p> <p>To be announced</p>	

		deficit, relativity and generation of energy; Fission-nature of fragments and emission of neutrons. 8. Nuclear reactor: slow neutrons interacting with Uranium-235; Fusion and thermonuclear reactions
Name of Teachers	Md Ashik Mondal	Md Ashik Mondal

Number of Classes	60 (Tentative)	120 (Tentative)
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#Component 2:

- 40Marks for Semester-end-Examination (will be organized by University)
- Answer 5 questions out of 8 carrying 02 marks each = 5 x 02 = 10 marks
- Answer 5 questions out of 7 carrying 03 marks each = 5 x 03 = 15 marks
- Answer 03 questions out of 05 carrying 5 marks each = 03x 5 = 15 marks
- Whole Syllabus of DSE 2A

- Practical (: ELEMENTS OF MODERN PHYSICS) = 20 Marks
Laboratory Note Book: 05 Marks
Viva- voce: 05 Marks
Experiment: 40 Marks (This 40 marks will be transformed into 10 Marks)

- A project File (Laboratory Note Book), comprising one exercise each is to be submitted.

Skill Enhancement Course – SEC 3

- Total 50 Marks
- 40 Marks(written exam) for Semester-end-Examination[#] (will be organized by University)
- 10 Marks for Class Test/ Assignment (will be organized by College in general and Department in Particular)

Internal Assessment	Component 1 (C ₁)	Component 2 (C ₂)
Weightage	5 Marks	1. 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.
Number of Questions	To be announced	
Date	To be announced	
Time	To be announced	
Syllabus	1. Introduction: Importance	

	<p>of computers in Physics, paradigm for solving physics problems for solution. Usage of linux as an Editor.</p> <p>2. 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</p>	<p>2. 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.</p> <p>3. 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, openfile, writing in a file, reading from a file. Examples from physics problems</p>
Name of Teacher(s)	Md Ashik Mondal	Md Ashik Mondal
Number of Classes	60 (Tentative)	120 (Tentative)
<p>#Component 2:</p> <ul style="list-style-type: none"> ➤ 40Marks for Semester-end-Examination (will be organized by University) ➤ Answer 5 questions out of 8 carrying 02 marks each = 5 x 02 = 10 marks ➤ Answer 5 questions out of 7 carrying 03 marks each = 5 x 03 = 15 marks ➤ Answer 03 questions out of 05 carrying 5 marks each = 03x 5 = 15 marks ➤ Internal assessment 10 		


Coordinator
Science Wing
Hiralal Bhakat College

Md. Ashik
Head
Department of.....Physics
Hiralal Bhakat College
Nalhati, Birbhum



Nurul Jh
Principal
Hiralal Bhakat College
Nalhati, Birbhum