

Department of Physics & Electronics

**Institute for Excellence in Higher Education (IEHE),
Bhopal (MP)**



**NAAC Re-accredited (Third Cycle) Autonomous College
Under the UGC Scheme with 'A' Grade (CGPA-3.10)**

**Program Outcomes (POs),
Program Specific Outcome (PSOs)
&
Course Outcomes (COs)
of
Department of Physics & Electronics**

**B.Sc. (Honours) Physics
&
M.Sc. (Physics)**

(Session: 2022-2023)

Programmes offered in the Institute

Under Graduate Programmes

- B.Com. (4-Year UG programme under NEP-2020)
- B.Com. Honours (Management/Account) (3-Year UG programme under old pattern)
- B.A. (Major: Economics/History/Psychology/Sociology/Political-Science/English-Literature/Hindi-Literature/Geography/Fashion Designing) (4-Year UG programme under NEP-2020)
- B.A. Honours (Economics/History/Psychology/Sociology/Political Science/English-Literature/Hindi-Literature/Geography/Fashion-Designing) (3-Year UG programme under old pattern)
- **B.Sc. (Major: Physics/Chemistry/Computer-Science/Mathematics/Electronics/Biotechnology/Geography/Forensic-Science/Clinical Nutrition and Dietetics) (4-Year UG programme under NEP-2020)**
- **B.Sc. Honours (Physics/Chemistry/Computer-Science/ Mathematics/Electronics/Biotechnology/Geography/Forensic-Science) (3-Year UG programme under old pattern)**
- B.B.A. (4-Year UG programme under NEP-2020) (New)
- B.P.E.S. (3-Year UG programme) (New)

Post Graduate Programmes

- MA (Economics)
- MA (English)
- MA (Hindi) (New)
- MA (History)
- MA (Political Science)
- MA (Psychology) (New)
- MA (Public Administration)
- MA (Sociology) (New)
- MA (Social Work)
- M.Sc. (Biotechnology)
- M.Sc. (Chemistry)
- M.Sc. (Mathematics)
- **M.Sc. (Physics)**
- M.Com. (Marketing Management)

Courses offered by Vocational Cell (IEHE)

Diploma Courses (14)

1. Diploma in Financial Services (**DFS**)
2. Diploma in Human Resources Development (**DHRD**)
3. Diploma in Communicative English (**DCE**)
4. Diploma in Counselling Psychology (**DCP**)
5. Diploma in Industrial Work & Management System (**DIWMS**)
6. Diploma in Statistical Analysis (**DSA**)
7. Diploma in Taxation (**DIT**)
8. Diploma in Creative Arts (**DCA**)
9. Diploma in Computer Application (**DCA**)
10. Diploma in Tourism & Hospitality Management (**DTHM**)
11. Diploma in Forensic Science (**DFSc.**)
12. Diploma in Hostel Management (**DHM**)
13. Diploma in Banking Financial Services and Insurance (**DBFSAI**)
14. Diploma in Retail Marketing Management (**DRMM**)

Certificate Courses (10)

1. Certificate Courses in English Creative Writing (**CECW**)
2. Certificate Courses in Embedded System (**CES**)
3. Certificate Courses in Research Methodology (**CRM**)
4. Certificate Courses in Instrumentation & Electronic Maintenance (**CIEM**)
5. Certificate Courses in Cyber Security (**CCS**)
6. Certificate Courses in Spoken English (**CSE**)
7. Certificate Courses in French Language (**CFL**)
8. Certificate Courses in Hostel Management (**CHM**)
9. Certificate Courses in Retail Marketing Management (**CRMM**)
10. Certificate Courses in Banking Financial Services and Insurance (**CBFSAI**)

Training Courses (06)

1. 45 Hours Training Programme in Food Processing & Preservation
2. 30 Hours Training Programme in **MATLAB**
3. 30 Hours Training Programme in **SPSS**
4. 30 Hours Training Programme in Tally
5. 30 Hours Training Programme in Traditional Art
6. CII-IWN-IEHE Finishing School

Special Courses

- Foundation Course in Civil Services Examinations (**FCCSE**)
- Joint Admission Test for M.Sc. (**JAM**)

Program Outcomes (PO) of the Under-Graduate Courses Offered

- PO1: Domain Knowledge:** Capable of demonstrating comprehensive knowledge & understanding of one or more other disciplines that form a part of an undergraduate programme of study.
- PO2: Critical Thinking:** Critically evaluate practices, policies and theories by following scientific approach to knowledge development. Take informed actions after identifying the assumptions that frame our thinking and actions, checking out the degree to which these assumptions are accurate and valid, and looking at our ideas and decisions (intellectual, organizational, and personal) from different perspectives.
- PO3: Problem Solving and Analytical Skills:** Ability to think rationally, analyse situations and solve problems adequately.
- PO4: Information and Digital Literacy:** Capability to use ICT in a variety of learning situations. Demonstrate ability to access, evaluate and use a variety of relevant information sources; and use appropriate software for analysis of data.
- PO5: Communication Skills:** The capacity to communicate effectively using appropriate media, to present complex information in a clear & concise manner. Acquire the learning abilities by focusing on LSRW (Listening, Speaking, Reading & Writing skill, which provide a stage to the students to sharpen their capacity to learn more.
- PO6: Social Interaction and sensitivity towards the societal issues:** Work effectively and respectfully with diverse teams; facilitate cooperative or coordinated effort on the part of a group and act together as a group or a team in the interests of a common cause. Elicit views of others, mediate disagreements and help reach conclusions in group settings.
- PO7: Self-directed & Life-long Learning:** Acquire the potential to engage in independent & life-long learning in the broadest context socio-technological changes. Critical sensibility to live experiences, with self-awareness and reflexivity of both and society.
- PO8: Environment and Sustainability:** Understand the issues of environmental contexts & sustainable development.
- PO9: Moral and Ethical Awareness:** Ability to embrace moral/ ethical values in conducting one's life, possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to effectively engage in a multicultural society and interact respectfully with diverse groups.
- PO10: Effective Citizenship:** Demonstrate empathetic social concern and equity centred national development, and the ability to act with an informed awareness of issues and participate in civic life through volunteering.
- PO11: Research-related skills:** A sense of inquiry and capability for asking relevant/appropriate questions, problematizing, synthesizing and articulating; Ability to recognize cause and effective relationships, define problems, formulate hypotheses, interpret and draw conclusions from data, ability to plan, execute and report the results of an experiment or investigation. Efficiency to apply one's learning to real life situations or in interdisciplinary areas.
- PO12: Leadership and Management Skills:** Competence to use skills in organizing for people to reach a shared goal. During leading a project, ability to motivate others to complete a series of tasks, often according to a schedule.
- PO13: Employability and Entrepreneurial Skill:** Ability to develop employability skills such as, positive attitude, good business sense, willingness to learn, resilience, ability to work under pressure, optimism, adaptability, perseverance and motivation, and a host of similar skills.

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PROGRAMME OUTCOMES (PO): B.Sc.

Predefined Programme Outcomes	<i>Students taking admission to this program of B.Sc. get equipped with following outcomes:</i>
PO1	Domain Knowledge: Acquiring knowledge of fundamentals, basic Mathematics, domain knowledge of proper scientific models and Computing Specialization from defined problems and explaining the basic scientific principles and methods.
PO2	Scientific thinking: Inculcating scientific thinking and awareness, getting an ability to use necessary current techniques, skills, and modern tools.
PO3	Problem Analysis: Identifying, formulating, & analysing complex problems, reaching substantiated conclusions using first principles of Mathematics, natural sciences and electronic sciences.
PO4	Communication: Communicate concepts, designs, and solutions of scientific activities effectively and professionally with society at large.
PO5	Information & Digital Literacy: Capability to use ICT in a variety of learning situations. Demonstrate ability to access, evaluate and use a variety of relevant information sources; and use appropriate software for analysis of data.
PO6	Ethical Awareness: Ability to embrace moral/ ethical values in conducting one's life, possess knowledge of the values and beliefs of multiple cultures and a global perspective; and capability to support the values required for collaborative work such as mutual trust & fairness.
PO7	Environment & Sustainability: Understanding the impact of scientific solutions on societal and environmental contexts and demonstrate knowledge of and need for sustainable development.
PO8	Self-directed and Life-long Learning: Acquire the ability to engage in independent and life- long learning in the broadest context socio-technological changes. Critical sensibility to live experiences, with self-awareness and reflexivity of both and society.
PO9	Research-related skills: <ul style="list-style-type: none"> • Acquiring familiarity with emerging areas of different subjects in science and their applications in various spheres of sciences and getting appraise of its relevance in future studies. • Getting ability to apply various statistical tools to research problems and ability to build statistical knowledge and knowing the statistical organization in India and abroad. • Developing scientific intuition, ability and techniques to tackle problems either theoretical or experimental in nature.
PO10	Employability Skill: Ability to develop employability skills such as, positive attitude, good business sense, willingness to learn, resilience, ability to work under pressure, optimism, adaptability, perseverance and motivation, and a host of similar skills.

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Programme Specific Outcomes (PSO): PHYSICS (*Honours/Major Subject*)

Programme Specific Outcomes	<i>The students taking up this program of BSc with Physics (Honours/Major) as a special subject of study, receive the following outcomes:</i>
PSO-1	Acquire a fundamental/systematic or coherent understanding of the academic field of physics, its different learning areas and applications in basic physics like material science, nuclear and particle physics, condensed matter physics, atomic and molecular physics, mathematical physics, and its linkages with related disciplinary areas/subjects like chemistry, mathematics, life sciences, environmental sciences, atmospheric physics, computer science, information technology.
PSO-2	Acquire a procedural knowledge that creates different types of professionals related to the Disciplinary/subject area of Physics, including professionals engaged in research and development, teaching and apart from this student can opt for government/public service
PSO-3	To equip students to handle the apparatus used in our daily life. To prepare students for a variety of carrier options in the field of Physics by accompanying all the Theory papers with appropriate Lab work including both performing practical's and preparing projects.
PSO-4	Demonstrate the ability to use skills in physics and its related areas of technology for formulating and tackling physics-related problems and identifying & applying appropriate physical principles & methodologies to solve a wide range of issues associated with physics in day-to-day life.
PSO-5	Recognize the importance of mathematical modelling simulation and computing, and the role of approximation and mathematical approaches to describing the physical world.
PSO-6	Plan and execute physics-related experiments or investigations, analyse and interpret data/information collected using appropriate methods, including the use of appropriate software such as programming languages and purpose-written packages, and report accurately the findings of the experiment/investigations while relating the conclusions/findings to relevant theories of physics.
PSO-7	To familiarize the students with the emerging areas of Physics such as Nanotechnology, Superconductivity, Condensed matter physics, LASER technology, Fibre Optics, Astrophysics, Space science etc. and their applications in various areas of Physical Sciences and to expose the students to use different processes used in the industry according to the pre-set requirement.
PSO-8	To develop communication skills involving the ability to listen carefully, to read texts and research papers analytically and to present complex information in a concise manner to different groups/audiences of technical or popular nature.
PSO-9	To encourage students to demonstrate professional behaviour such as being objective, unbiased and truthful in all aspects of work and avoiding unethical, irrational behaviour such as fabricating, falsifying or misrepresenting data or committing plagiarism.

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Mapping of PSO's BSc. Physics (*Honours/Major*) with POs of Under-Graduate

	P01	P02	P03	P04	P05	P06	P07	P08	P09	P010
PSO-1	*	--	--	--	*	--	*	*	--	*
PSO-2	--	--	--	--	--	--	*	--	*	*
PSO-3	--	--	*	*	--	--	--	--	--	*
PSO-4	--	--	*	*	--	--	*	*	*	*
PSO-5	*	*	--	--	*	--	--	--	*	--
PSO-6	*	*	*	--	*	*	--	*	*	*
PSO-7	--	--	--	--	--	--	--	--	*	*
PSO-8	--	--	*	*	--	*	--	*	*	*
PSO-9	--	*	*	--	--	*	--	*	--	*

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Course Outcomes (COs)

Semester: I

Thermal Physics (Paper Code: MJS-171) (Major)

Course Outcomes	<i>The students taking up this course of BSc with Physics (Major) as a special subject of study receive the following outcomes:</i>
CO-1	Define, state and comprehend the basic concepts of thermodynamics, the first and second law of thermodynamics, the concept of entropy and the associated theorems, the thermodynamic potentials and their physical interpretations.
CO-2	Perceive the basic aspects of kinetic theory of gases, Maxwell-Boltzman distribution law, equipartition of energies, mean free path of molecular collisions, viscosity, thermal conductivity, diffusion and Brownian motion.
CO-3	Describe about the real gas equations, Vander Waal equation of state, the Joule-Thompson effect.
CO-4	In the laboratory course, the students are expected to do some basic experiments in thermal Physics, viz., determinations of coefficient of thermal conductivity, temperature coefficient of resistance, variation of thermo-emf of a thermocouple with temperature difference at its two junctions and calibration of a thermocouple.

Semester: I

Mechanics (Paper Code: MNS-172) (Minor)

Course Outcomes	<i>The students taking up this course of BSc with Physics (Minor) as a special subject of study receive the following outcomes:</i>
CO-1	Illustrate laws of motion and their application to various dynamical situations, notion of inertial frames and concept of Galilean invariance. He / she will be able to recall the concept of conservation of energy, momentum, angular momentum and apply them to basic problems.
CO-2	Associate the analogy between translational and rotational dynamics, and application of both motions simultaneously in analysing rolling with slipping.
CO-3	Perceive the concept of moment of inertia about the given axis of symmetry for different uniform mass distributions. Understand the phenomena of collisions and idea about centre of mass and laboratory frames and their correlation.
CO-4	Perceive simple principles of fluid flow and the equations governing fluid dynamics.
CO-5	Explain the phenomena of simple harmonic motion and the properties of systems executing such motions.

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Semester: I

Mechanics (Paper Code: GES-171) (Generic Elective)

Course Outcomes	<i>The students taking up this course of BSc with Physics (Generic Elective) as a special subject of study receive the following outcomes:</i>
CO-1	Recall the laws of motion and their application to various dynamical situations. He / she will illustrate the concept of conservation of energy, momentum, angular momentum and apply them to basic problems.
CO-2	Illustrate the concept of moment of inertia about the given axis of symmetry for different uniform mass distributions.
CO-3	Perceive the phenomena of collisions and idea about centre of mass and laboratory frames and their correlation.
CO-4	Describe the principles of elasticity through the study of Young Modulus and modulus of rigidity.

Semester: II

Core-Mechanics (Paper Code: MJS-271) (Major)

Course Outcomes	<i>The students taking up this course of BSc with Physics (Major) as a special subject of study receive the following outcomes:</i>
CO-1	Explain laws of motion and their application to various dynamical situations, notion of inertial frames and concept of Galilean invariance. He / she will be able to recall the concept of conservation of energy, momentum, angular momentum and apply them to basic problems.
CO-2	Associate the analogy between translational and rotational dynamics, and application of both motions simultaneously in analysing rolling with slipping.
CO-3	Perceive the concept of moment of inertia about the given axis of symmetry for different uniform mass distributions. Understand the phenomena of collisions and idea about centre of mass and laboratory frames and their correlation.
CO-4	Classify simple principles of fluid flow and the equations governing fluid dynamics.
CO-5	Explain the phenomena of simple harmonic motion and the properties of systems executing such motions.

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Semester: II

Thermal Physics (Paper Code: MNS-272) (Minor)

Course Outcomes	The students taking up this course of BSc with Physics (Minor) as a special subject of study receive the following outcomes:
CO-1	Comprehend the basic concepts of thermodynamics, the first and the second law of thermodynamics, the concept of entropy and the associated theorems, the thermodynamic potentials and their physical interpretations.
CO-2	Define the basic aspects of kinetic theory of gases, Maxwell-Boltzmann distribution law, equipartition of energies, mean free path of molecular collisions, viscosity, thermal conductivity, diffusion and Brownian motion.
CO-3	Describe about the real gas equations, Vander Waal equation of state, the Joule-Thompson effect.
CO-4	In the laboratory course, the students are expected to do some basic experiments in thermal Physics, viz., determinations of coefficient of thermal conductivity, temperature coefficient of resistance, variation of thermo-emf of a thermocouple with temperature difference at its two junctions and calibration of a thermocouple.

Semester: II

Thermal Physics & Statistical Mechanics (Paper Code: GES-271) (Generic Elective)

(Not opted by the students in the session 2022-2023)

Course Outcomes	The students taking up this course of BSc with Physics (Generic Elective) as a special subject of study receive the following outcomes:
CO-1	Comprehend the basic concepts of thermodynamics, the first and the second law of thermodynamics, the concept of entropy and the associated theorems, the thermodynamic potentials and their physical interpretations.
CO-2	Describe the basic aspects of kinetic theory of gases, Maxwell-Boltzmann distribution law, equipartition of energies, mean free path of molecular collisions, viscosity, thermal conductivity, diffusion and Brownian motion.
CO-3	Explain about the real gas equations, Vander Waal equation of state, the Joule-Thompson effect.
CO-4	Explain the black body radiation, Stefan's Boltzmann Law, Rayleigh Jeans Law, Planck's Law and their significance, quantum statistical distributions.
CO-5	In the laboratory course, the students are expected to do some basic experiments in thermal Physics, viz., determinations of coefficient of thermal conductivity, temperature coefficient of resistance, variation of thermo-emf of a thermocouple with temperature difference at its two junctions and calibration of a thermocouple.

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Semester: III

Wave & Optics (Paper Code: MJS-371) (Major)

Course Outcomes	<i>The students taking up this course of BSc with Wave & Optics (Major) as a special subject of study receive the following outcomes:</i>
CO-1	Recognize and use mathematically oscillator equation and wave equation and derive these equations for various systems.
CO-2	Apply basic knowledge of principles and theories about the behaviour of light and the physical environment to conduct experiments.
CO-3	Perceive the principle of superposition of waves, so they can describe the formation of standing waves.
CO-4	Use the principles of wave motion and superposition to explain the physics of polarization, interference and diffraction.
CO-5	Explain the working of selected optical instruments like biprism, interferometer, diffraction grating and holograms.

Semester: III

Electricity, Magnetism & Electromagnetic Theory (Paper Code: MNS-372) (Minor)

Course Outcomes	<i>The students taking up this course of BSc with Electricity, Magnetism & Electromagnetic Theory (Minor) as a special subject of study receive the following outcomes:</i>
CO-1	Demonstrate Gauss Law, Coulombs Law for the electric field and apply it to systems of point charges as well as line, surface volume distribution of charges.
CO-2	Explain and differentiate the vector (electric field's, Coulomb's Law) and scalar (electric potential, electric potential energy) formalism of electrostatics.
CO-3	Apply the knowledge of electric current, resistance and capacitor in terms of electric field and electric potential.
CO-4	Explain Faraday-Lenz and Maxwell laws to articulate the relationship between electric and magnetic fields.
CO-5	Perceive the dielectric properties, magnetic properties of materials and the phenomenon of electromagnetic induction
CO-6	Apply Kirchoff's rules to analyse AC circuits consisting of parallel and/or series combinations of voltage sources and resistors and to describe the graphical relationship of resistance, capacitor and inductor.

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Semester: III

Electricity & Magnetism (Paper Code: GES-371) (Generic Elective)

Course Outcomes	<i>The students taking up this course of BSc with Electricity & Magnetism (Generic Elective) as a special subject of study receive the following outcomes:</i>
CO-1	Demonstrate Gauss Law, Coulombs Law for the electric field and apply it to systems of point charges as well as line, surface volume distribution of charges.
CO-2	Explain and differentiate the vector (electric field's, Coulomb's Law) and scalar (electric potential, electric potential energy) formalism of electrostatics.
CO-3	Apply the knowledge of electric current, resistance and capacitor in terms of electric field and electric potential.
CO-4	Explain Faraday-Lenz and Maxwell laws to articulate the relationship between electric and magnetic fields.
CO-5	Perceive the dielectric properties, magnetic properties of materials and the phenomenon of electromagnetic induction

Semester: III

Physics Workshop Skill (Paper Code: Voc/SEC-371) (Voc/SEC)

Course Outcomes	<i>The students taking up this course of BSc with Physics Workshop Skill (Voc/SEC) as a special subject of study receive the following outcomes:</i>
CO-1	Recall measuring units, meter scale and perform measurement of dimension of a solid block, volume of cylinder beaker, thickness of metal sheet.
CO-2	Make use of sextant to measure height of buildings, mountains etc.
CO-3	Classify different properties of matter.
CO-4	Analyse ideal and viscous fluids and explain Bernoulli's theorem through applications
CO-5	Operate multimeter, ICs on PCB, oscilloscope.

Semester: IV

Magnetism & Electromagnetic Theory (Paper Code: MJS-471) (Major)

Course Outcomes	<i>The students taking up this course of BSc with Magnetism & Electromagnetic Theory (Major) as a special subject of study receive the following outcomes:</i>
CO-1	State and describe Maxwell's Equation for EMT radiation.
CO-2	Compare the basic aspect of dispersion of EM radiations in various medias.
CO-3	Demonstrate the building concept of EM vector and EM potentials, concept of Gauge, i.e Lorent's and Coulomb's gauge. Apply the gauges in solving the EM wave propagation.
CO-4	Illustrate basic concepts of Fourier analysis and solutions in homogeneous wave equation using Fourier analysis, Lienard- wiechert potentials and their use in studying movement of point charge. Mathematical formulation of moving point charge and EM wave field associated with moving charge.

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CO-5	Identify Introduction to waveguides and propagation of EM waves with different modes in rectangular wave guides, Analysis of waveguides with determination of cutoff wavelength and guide wave length in circular and rectangular waveguides.
CO-6	Discuss and explain Introduction to Optical Fibre Communication system and the concept building of optical fibre transmission theory, Fabrication techniques and applications of Optical fibre. Introduction to various sources related to Optical Fibre communication.

Semester: IV

Wave & Optics (Paper Code: MNS-472) (Minor)

Course Outcomes	<i>The students taking up this course of BSc with Wave & Optics (Minor) as a special subject of study receive the following outcomes:</i>
CO-1	Recognize and use mathematically oscillator equation and wave equation and derive these equations for various systems.
CO-2	Apply basic knowledge of principles and theories about the behaviour of light and the physical environment to conduct experiments.
CO-3	Perceive the principle of superposition of waves, so they can describe the formation of standing waves.
CO-4	Use the principles of wave motion and superposition to explain the physics of polarization, interference and diffraction.
CO-5	Explain the working of selected optical instruments like biprism, interferometer, diffraction grating and holograms

Semester: IV

Wave & Optics (Paper Code: GES-471) (Generic Elective)

Course Outcomes	<i>The students taking up this course of BSc with Wave & Optics (Generic Elective) as a special subject of study receive the following outcomes:</i>
CO-1	Recognize and use mathematically oscillator equation and wave equation and derive these equations for various systems.
CO-2	Apply basic knowledge of principles and theories about the behaviour of light and the physical environment to conduct experiments.
CO-3	Perceive the principle of superposition of waves, so they can describe the formation of standing waves.
CO-4	Use the principles of wave motion and superposition to explain the physics of polarization, interference and diffraction.
CO-5	Explain the working of selected optical instruments like biprism, interferometer, diffraction grating and holograms

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Semester: IV

Basic Instrumentation Skill (Paper Code: Voc/SEC-471) (Voc/SEC)

Course Outcomes	<i>The students taking up this course of BSc with Basic Instrumentation Skill (Voc/SEC) as a special subject of study receive the following outcomes:</i>
CO-1	Validate voltage and current using multimeter.
CO-2	Measure amplitude and frequency using CRO.
CO-3	Measure passive elements using CRO.

Semester: V

Digital Electronics & Computers (Paper Code: S-571) (Honours-I)

Course Outcomes	<i>The students taking up this course of BSc with Physics (Honours-I) as a special subject of study receive the following outcomes:</i>
CO-1	Perceive and compute Binary, octal, hexadecimal and BCD number system. Familiarization with the various Binary mathematical operations such as addition, subtraction, 1's compliment and 2's compliment, etc.
CO-2	Solve Boolean expressions and K-maps.
CO-3	Perceive and make diagram of Logics gates, their truth table and applications, Different logic families and their specification.
CO-4	Classify and make diagrams of digital devices such as Flip-Flop, Registers, Counters, Multiplexers and encoders.
CO-5	Describe and classify digital memory devices such as RAM, ROM, DRAM, PROM, etc. Computer Storage devices such as floppy disk, magnetic tapes and Hard disk.

Semester: V

Quantum Mechanics, Atomic & Molecular Spectroscopy & Nuclear Physics

(Paper Code: S-572) (Honours-II/Subsidiary)

Course Outcomes	<i>The students taking up this course of BSc with Physics (Honours-II/Subsidiary) as a special subject of study receive the following outcomes:</i>
CO-1	Describe basic concepts of Quantum mechanics, concept of duality, probability, uncertainty principle and wave function.
CO-2	Discuss Schrödinger wave equation and its applications, decay phenomena, harmonic oscillators and rotators.
CO-3	Reproduce Atomic model and spectrum analysis, fine structure, concept of spin and Zeeman effect.
CO-4	Explain Types of spectra, zero-point energy, Raman Effect, fluorescence and phosphorescence.
CO-5	Explain basic properties of nucleus, structure and stability of nucleus. A different type of emissions, nuclear reaction, and models of nucleus.

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Semester: VI

Introduction to Instrumentation (Paper Code: S-671) (Honours-I)

Course Outcomes	<i>The students taking up this course of BSc with Physics (Honours-I) as a special subject of study receive the following outcomes:</i>
CO-1	Recall measurement standards of measuring instruments.
CO-2	Illustrate the Familiarization and theories of various electrical bridges and their practical use.
CO-3	Perceive the concept of signal conditioning and uses of various devices.
CO-4	Discuss the fundamentals, construct CRO & CRT, and describe various uses of CRO.
CO-5	Describe various sensors and their working principles.

Semester: VI

Solid State Physics & Nonmaterial (Paper Code: S-672) (Honours-II/Subsidiary)

Course Outcomes	<i>The students taking up this course of BSc with Physics (Honours-II/Subsidiary) as a special subject of study receive the following outcomes:</i>
CO-1	Perceive the concepts of crystal structures and their bonding has and uses of X-rays in crystal structure state.
CO-2	Knowledge building of lattice structures and their properties.
CO-3	Describe various Electronic devices, their fabrication and applications.
CO-4	Discuss semiconductor devices and oscillators.
CO-5	Compare nanotechnology from other technology and describe application of nanomaterials.

A brief note on Bloom's Taxonomy:

According to the revised version of Bloom's Taxonomy there are six levels of cognitive learning. Each level is conceptually different. The six levels are (1) remembering, (2) understanding, (3) applying, (4) analyzing, (5) evaluating, and (6) creating. We follow the Bloom's Taxonomy in deciding the course outcome & the levels (1/2/3/4/5/6) are displayed in the mapping table of COs with the PSOs of each program of NEP-2020. Details of the terms used in the levels are as follows:

Level-1: **REMEMBER** - this level include:

cite, define, describe, identify, label, list, match, name, outline, quote, recall, report, reproduce, retrieve, show, state, tabulate, and tell.

Level-2: **UNDERSTAND** - this level include:

abstract, arrange, articulate, associate, categorize, clarify, classify, compare, compute, conclude, contrast, defend, diagram, differentiate, discuss, distinguish, estimate, exemplify, explain, extend, extrapolate, generalize, give examples of, illustrate, infer, interpolate, interpret, match, outline, paraphrase, predict, rearrange, reorder, rephrase, represent, restate, summarize, transform, and translate.

Level-3: **APPLY** - this level include:

apply, calculate, carry out, classify, complete, compute, demonstrate, dramatize, employ, examine, execute, experiment, generalize, illustrate, implement, infer, interpret, manipulate, modify, operate, organize, outline, predict, solve, transfer, and use.

Level-4: **ANALYZE** - this level include:

analyze, arrange, break down, categorize, classify, compare, contrast, deconstruct, detect, diagram, differentiate, discriminate, distinguish, divide, explain, identify, integrate, inventory, order, organize, relate, separate, and structure.

Level-5: **EVALUATE** - this level include:

appraise, apprise, argue, assess, compare, conclude, consider, contrast, convince, criticize, critique, decide, determine, discriminate, evaluate, grade, judge, justify, measure, rank, rate, recommend, review, score, select, standardize, support, test, and validate.

Level-6: (highest level): **CREATE** - this level include:

arrange, assemble, build, collect, combine, compile, compose, constitute, construct, create, design, develop, devise, formulate, generate, hypothesize, integrate, invent, make, manage, modify, organize, perform, plan, prepare, produce, propose, rearrange, reconstruct, reorganize, revise, rewrite, specify, synthesize, and write.

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Programme: BSc (Major/Honours-I)

Subject: Physics

Mapping of COs with PSOs for Semester-I (Major)

Course		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
<i>Paper Title: Thermal Physics</i>	CO1	1									
	CO2	2									
<i>Paper Code: MJS-171</i>	CO3	1									
	CO4			5			5				

Mapping of COs and PSOs for Semester-II (Major)

<i>Paper Title: Core Mechanics</i>	CO1	1									
	CO2	2									
<i>Paper Code: MJS-271</i>	CO3	2									
	CO4	4									
	CO5	1									

Mapping of COs and PSOs for Semester-III (Major)

<i>Paper Title: Wave & Optics</i>	CO1	1									
	CO2	3									
<i>Paper Code: MJS-371</i>	CO3	2									
	CO4		4								
	CO5		5	5				5			

Mapping of COs and PSOs for Semester-IV (Major)

<i>Paper Title: Magnetism & Electromagnetic Theory</i>	CO1	1									
	CO2	2									
	CO3	3			3						
	CO4	3									
<i>Paper Code: MJS-471</i>	CO5			4				4			
	CO6							4			

Mapping of COs and PSOs for Semester-V (Honours-I)

<i>Paper Title: Digital Electronics & Computers</i>	CO1	2									
	CO2	3									
<i>Paper Code: S-571</i>	CO3	2		2		2					
	CO4	3			3						
	CO5	1,2									

Mapping of COs and PSOs for Semester-VI (Honours-I)

<i>Paper Title: Introduction to Instrumentation</i>	CO1	1									
	CO2	2									
<i>Paper Code: S-671</i>	CO3	3									
	CO4	4									
	CO5	1									

Department of Physics & Electronics

Programme: BSc (Minor/Honours-II)

Subject: Physics

Mapping of COs with PSOs for Semester-I (Minor)

Course		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
Paper Title: Mechanics Paper Code: MNS-172	CO1	1									
	CO2	2									
	CO3	2									
	CO4	4									
	CO5	1									

Mapping of COs and PSOs for Semester-II (Minor)

Paper Title: Thermal Physics Paper Code: MNS-272	CO1	1									
	CO2	2									
	CO3	1									
	CO4			5			5				

Mapping of COs and PSOs for Semester-III (Minor)

Paper Title: Electricity, Magnetism & Electromagnetic Theory Paper Code: MNS-372	CO1	1									
	CO2	2									
	CO3	3			3						
	CO4	3									
	CO5			4				4			
	CO6							4			

Mapping of COs and PSOs for Semester-IV (Minor)

Paper Title: Wave & Optics Paper Code: MNS-472	CO1	1									
	CO2	3									
	CO3	2									
	CO4		4								
	CO5		5	5				5			

Mapping of COs and PSOs for Semester-V (Honours-II/Subsidiary)

Paper Title: Quantum Mechanics, Atomic & Molecular Spectroscopy & Nuclear Physics Paper Code: S-572	CO1	1									
	CO2	2									
	CO3		6		6		6				
	CO4	1									
	CO5	4									

Mapping of COs and PSOs for Semester-VI (Honours-II/Subsidiary)

Paper Title: Solid State Physics & Nonmaterial Paper Code: S-672	CO1	2									
	CO2										
	CO3	1									
	CO4	2									
	CO5	2									

Department of Physics & Electronics

Programme: BSc (Generic Elective/Vocational)

Subject: Physics

Mapping of COs with PSOs for Semester-I (Generic Elective)

Course		PSO1	PSO2	PSO3	PSO4	PSO5	PSO6	PSO7	PSO8	PSO9	PSO10
<i>Paper Title: Mechanics</i>	CO1	1									
<i>Paper Code: GES-171</i>	CO2	2									
	CO3	2									
	CO4	4									
	CO5	1									

Mapping of COs and PSOs for Semester-II (Generic Elective)

<i>Paper Title: Thermal Physics & Statistical Mechanics</i>	CO1	1									
	CO2	2									
	CO3	1									
<i>Paper Code: GES-271</i>	CO4			5			5				

Mapping of COs and PSOs for Semester-III (Generic Elective)

<i>Paper Title: Electricity & Magnetism</i>	CO1	3									
	CO2	1									
<i>Paper Code: GES-371</i>	CO3	3		3							
	CO4	1,4									
	CO5	2									

Mapping of COs and PSOs for Semester-IV (Generic Elective)

<i>Paper Title: Waveguides & Optics</i>	CO1	1									
	CO2	3									
<i>Paper Code: GES-471</i>	CO3	2									
	CO4		4								
	CO5		5	5				5			

Mapping of COs and PSOs for Semester-III (Voc/SEC) (Vocational)

<i>Paper Title: Physics Workshop Skill</i>	CO1	1									
	CO2						6				
<i>Paper Code: Voc/SEC-XXX</i>	CO3	4									
	CO4	4									
	CO5			5		5					

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Mapping of COs and PSOs for Semester-IV (Voc/SEC) (Vocational)

Course		PS01	PS02	PS03	PS04	PS05	PS06	PS07	PS08	PS09	PS010
<i>Paper Title: Basic Instrumentation Skill</i>	2										2
<i>Paper Code:</i>		5									
<i>Voc/SEC-XXX</i>		5									


(IQAC Coordinator)


(Convenor, Academic Committee)


(HOD, Physics & Electronics)

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