

2.6.1 Teachers and students are aware of the stated programme and course outcomes of the programmes offered by the institution.



LPCPS
LUCKNOW PUBLIC COLLEGE
OF PROFESSIONAL STUDIES

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BACHELOR OF SCIENCE B.Sc (PCM)

(SESSION 2023-2024)

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BACHELOR OF SCIENCE B.Sc (PCM)

Program Outcomes Bachelor of Science (B. Sc) offers theoretical as well as practical knowledge on different subject areas. These subject areas include Physics, Chemistry, Mathematics and other fields depending on the specialization & combinations a student opts for this programme course is most beneficial for students who have a strong interest and background in Science and Mathematics. The course is also beneficial for students who wish to pursue multi and inter-disciplinary science careers in future. It is also the gateway for post-graduation in research in topics pertaining to science.

Programme Outcomes (PO):

- This course forms the basis of science and comprises of the subjects like physics, chemistry and mathematics.
- It helps to develop scientific temper and thus can prove to be more beneficial for the society as the scientific developments can make a nation or society to grow at a rapid pace, especially in medicine, engineering & research.
- After the completion of this course students have the option to go for higher studies i.e., M. Sc and then do some research for the welfare of mankind.
- After higher studies students can join as scientist and can even look for professional job-oriented courses.
- This course also offers opportunities for serving in Indian Army, Indian Navy and Indian Air Force as officers.
- Students after this course have the option to join Indian administrative Services such as IAS, IFS, Allied services IPS etc.
- Science graduates can go to serve in industries or may opt for establishing their own industrial unit.
- After the completion of the B. Sc degree there are various other options available for the science students. Often, in some reputed universities or colleges in India and abroad the students are recruited directly by big MNC's after their completion of the course.

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- Apart from the research jobs, students can also work or get jobs in Marketing, Business & Other technical fields. Science graduates also gets recruited in the banking sector working as customer service executives. Students can also find employment in various government sectors.

Program Specific Outcomes (PSO):

- B.Sc. student is able to concentrate on Chemistry, Physics and Mathematics.
- A student will demonstrate a scientific knowledge of the core physics principles in Mechanics, Electromagnetism, Modern Physics, and Optics.
- He is able to demonstrate basic manipulative skills in algebra, geometry, trigonometry, and beginning calculus.
- The student will determine the appropriate level of technology for use in:
 - a) Experimental design and implementation.
 - b) Analysis & interpretation of experimental data.
 - c) Numerical and mathematical methods in problem solutions.
- He will be able to apply the underlying unifying structures of mathematics (i.e., sets, relations and functions, logical structure) and establish the relationships among them.
- He can investigate and apply mathematical problems and solutions in a variety of contexts related to science, technology, business and industry, and illustrate these solutions using symbolic, numeric, or graphical methods.
- The student will acquire knowledge of Chemical Thermodynamics, Kinetics, Electrochemistry, Atomic Structure, Organic Chemistry, Spectroscopy and Skill in Industrial Chemistry.
- He will gain knowledge of Geography in Indian Context and also Global Geography. He will know about forests, mountains, lakes, rivers, soil & environment pollution
- A non-medical student can join Indian Air Force, Indian Navy and can also go for other competitive exams. He can go for higher studies in Mathematics, Chemistry and Physics.

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- He can join as a scientist in research institutes of immense knowledge having a great scope for growth and development. He can prove to be an asset for the society by producing something more innovative schemes.
- Banking sector is another good option for students of science with good mathematical background.

Session 2023-24

Syllabus

PAPER CODE	SUBJECT NAME
SEMESTER V	
PHYSICS	
P9	PHY501 Solid State Physics
P10	PHY502 Nuclear Physics
P11x	PHY503 Lasers and Optoelectronics I
P11y	PHY504 The Second Quantum Revolution
CHEMISTRY	
PAPER 9	Organic Chemistry 2
PAPER10	Physical Chemistry 2
PAPER 11x	Analytical Chemistry
PAPER 11y	Chemical Energetics and Radiochemistry
IS	Chemistry Internship (Chemistry Practical 5)
P9'	Second major subject
P10'	Second major subject
MATHEMATICS	
P-9	NUMERICAL ANALYSIS
P-10	ANALYSIS
P-11 A	INTEGRAL & PARTIAL DIFFERENTIAL EQUATIONS
P-11 B	DISCRETE MATHEMATICS
P-11C	NUMBER THEORY
SEMESTER VI	
PHYSICS	
P12	PHY601 Advanced Lab
P13	PHY602 Atomic & Molecular Spectroscopy
P14x	PHY603 History of Science in India
P14y	PHY604 Plasma Physics and Space Science

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CHEMISTRY	
Paper 12	Inorganic Chemistry
Paper 13	Quantum Mechanics and Spectroscopy (Physico Organic)
Paper 14 x	Polymer Chemistry
Paper 14 y	Chemistry of Natural Products
MP	Chemistry Minor Project (Chemistry Practical 6)
P11'	Second major subject
P12'	Second major subject
MATHEMATICS	
P-12	Advanced Algebra
P-13	Differential Geometry & Tensor Analysis
P-14 A	Advanced Differential Equations
P-14 B	Operations Research

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COURSE OUTCOMES

SEMESTER V

THEORY

P9 PHY501-Solid State Physics

Course Outcomes:

This syllabus aims to introduce the theoretical and experimental topics in solidstate physics. On successful completion of the units students would get an understanding of

- The crystal geometry with respect to symmetry operations
- The power of X-ray diffraction and the concept of reciprocal lattice
- The various properties based on crystal bindings
- Lattice dynamics and its influence on the properties of materials,
- Physics of electrons in solids and Magnetic, dielectric and superconducting properties of solids along with recent published results by various researchers.
- Such study would provide a foundation for research in condensed matter physics, material science and nanotechnology.

THEORY

P10 PHY502-Nuclear Physics

Course outcomes:

After successful completion of the course on Nuclear Physics, students will:

- Grasp the knowledge about basic nuclear properties and nuclear

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- models for a better understanding of nuclear reaction dynamics.
- Analyze quantum mechanical phenomena in nuclear physics and develop an understanding of quantum mechanics also.
 - Comprehend the general understanding of phenomena like nuclear fusion and fission and develop the skills required for solving basic problems in nuclear physics at different nuclear energy ranges.
 - Develop the basic understanding of accelerator physics and particle detectors.
 - Acquire and apply basic nuclear physics knowledge in subjects such as medicinal, archaeology, geology, and other multidisciplinary fields of Physics and Chemistry.

THEORY

P11x PHY503-Lasers and Optoelectronics I

Course Outcomes:

Opting for this course will give the students an opportunity to know and understand applications of fiber optics and laser technology.

- Students will be able to appreciate the importance of lasers, fiber optical methods and sensors in all spheres of life i.e. various communication requirements, medical, travel etc.
- Students will learn about optical fibers in detail and will be able to appreciate the current communication system existing globally.
- They will also gain the knowledge of basic concepts of optical communication and of different types of optical fibers thereby getting enabled to appreciate the huge advantage of such systems.
- Students will be able to know about various types of fiber optic sensors and their use in the areas of security, safety, medical and space ventures.
- Finally, students may emerge with an idea for new sensor or a new application of the existing ones.

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THEORY

P11y PHY504-The Second Quantum Revolution

Course Outcomes

In the 1970s and 1980s instead of looking at quantum systems purely as phenomena to be explained scientists began looking at these systems that could be designed to accommodate computer science and information theory. An enormous amount of progress has taken place in the field of quantum information science in the last twenty years. The most remarkable progress has been in the actual implementation of these quantum systems via superconducting circuits or nuclear spins or single photon systems or trapped ions. It becomes imperative that we develop at least a basic understanding of things to come. Quantum Computation is the future.

The main outcomes this course aims to achieve are as follows:

- To understand the main ideas of quantum computation.
- To develop an understanding of the fundamental concepts of the field.
- To equip the student with enough technical expertise to may be take up a career in this new, exciting and rich field of research.
- To introduce some experimental developments pertaining to quantum computers.

THEORY

Organic Chemistry 2

PAPER 9

Course outcome

The completion of this course enables the student to understand the subject initially

- CO-1 The preparation and chemical reactions of Alcohols and Epoxides - Alcohols Dihydric alcohols: (Ethylene Glycol)

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- CO-2 Understanding the order of reactivity of different carboxylic acid derivatives and the reactivity of different carboxylic acid derivatives.
- CO-3 Able to recognize structures of acid halides, esters, amides, acid anhydrides.
- CO-4 Able to write down structure of phenol and phenoxide ion and chemical reactions of phenols.
- CO-5 Know the mechanism of named reactions of carbonyl compounds and condensation reactions as well as their use in food and pharmaceuticals.

THEORY

Physical Chemistry 2

PAPER 10

Course outcome

- CO-1- After the completion of the semester, student will acquire knowledge of first law and second law of thermodynamics, thermochemistry, entropy enthalpy etc.
- CO-2- It will also make them familiar with conductance, equivalent conductance, Kohlrausch's law, Ostwald dilution law, Deby-Huckel Onsagar equation, e.m.f. of cell, types of cell, liquid junction potential, pH and pka, Henderson- Hazel equation etc.

THEORY

Analytical Chemistry (Chemistry Elective 1)

Paper 11X

Course Outcome:

- CO 1. Understand the basic of this course and think & develop new ideas and concepts in analytical chemistry.

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- CO 2. Know about electroanalytical, thermoanalytical, radiochemical, chromatographic and spectral techniques.
- CO 3. To study concepts and theories behind basic methods and techniques used in analytical chemistry. This theory can be used to solve many rigorous problems of universe.
- CO 4. To prepare the students for further research in analytical methods of chemistry.

THEORY

Chemical Energetics and Radiochemistry (Chemistry Elective 2)

Paper 11Y

Course Outcome:

Student will

- CO 1. Understand the introductory quantum mechanics and concept of third law of thermodynamics, distribution law and phase rule. CO 2. Get introduced to the law of photochemistry and photosensitized reactions energy transfer processes.
- CO 3. Study about the dilute solutions and colligative properties.
- CO 4. Get familiar with radiopharmaceuticals and radiochemistry.

Chemistry Internship (Chemistry Practical 5) IS

Course Outcome

After completing the course, the student will be able to: -

- CO-1 Having acquired knowledge to handle instruments and its calibration.
- CO-2 Explain the structure and bonding in molecules / ions and predict the structure of

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- molecules / ions.
- CO-3 Explain selected crystal structures, explain and perform calculations of the lattice enthalpy of ionic compounds.
 - CO-4 Having knowledge of Beer Lamberts law
 - CO-5 To separate compounds chromatographically.
 - CO-6 Able to make solutions accurately to perform conductance experiments.
 - CO-7 To understand making circuit connections and taking observations.

THEORY

NUMERICAL ANALYSIS

PAPER 9

Course Outcomes

- Some numerical methods to find the zeroes of nonlinear functions of a single variable and solution of a system of linear equations, up to a certain given level of precision.
- Interpolation techniques to compute the values for a tabulated function at points not in the table.
- Applications of numerical differentiation and integration to convert differential equations into difference equations for numerical solutions.

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THEORY

ANALYSIS

PAPER 10

Course Outcomes:

- Understand the basic concepts of metric spaces.
- Know the concepts such as open balls, closed balls, compactness, connectedness etc.
- Understand the significance of differentiability of complex valued functions leading to the understanding of Cauchy-Riemann equations.
- Evaluate the contour integrals and understand the role of Cauchy- Goursat theorem and the Cauchy integral formula.
- Expand some simple functions as their Taylor and Laurent series, classify the nature of singularities, find residues and apply Cauchy Residue theorem to evaluate integrals.

THEORY

INTEGRAL & PARTIAL DIFFERENTIAL EQUATIONS

PAPER 11 A

Course Outcomes

- Describe different types of Linear integral equations and partial differential equations for

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- the impart knowledge of formulation of practical problems of applied mathematics.
- Understand the theoretical basic behavior of different types of arising problems such as Fredholm, Volterra, Singular, Hilbert and Cauchy integral equations.
 - Explain the foundations of various problems related to Wave, Laplace and Diffusion equations by the method of separation of variables.
 - Deal with problems in applied mathematics, theoretical mechanics and mathematical physics and engineering.

THEORY

DISCRETE MATHEMATICS

PAPER 11 B

Course Outcomes:

- Lattices and their types.
- Boolean algebra, switching circuits and their applications.
- Graphs, their types and its applications in study of shortest path algorithms.
- Display familiarity with the mathematical models which are the integral part of the hardware and software of computer science.
- Elaborate and expand their understanding of the tools helpful in the implementation of circuit design, AI algorithms and compiler construction.

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THEORY

NUMBER THEORY

PAPER 11C

Course Outcomes

- To have knowledge of primes, congruences, quadratic residues and primitive roots.
- Solving Diophantine equations.
- Derive generating functions and recurrence relations.

INTERNSHIP

SEMESTER VI

P12 PHY601-Advanced LAB

Course Outcomes

- Measurement precision and perfection is achieved through LabExperiments.
- The experiments in advance laboratory will enable students to be industry ready in the field of electronics.
- The exposure to this laboratory will enable students to do research in applied optics and optoelectronics.
- The students will be able to appreciate the concept of electronic communication.
- Online Virtual Lab Experiments give an insight in simulation techniques and provide a basis for modeling.

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THEORY

P13 PHY602-Atomic and Molecular Spectroscopy

Course Outcomes

- After completion of the course students will be able to understand the spectra produced by one and two valence electron systems, intensity of spectral lines and effect of magnetic field on one electron systems as well as origin of hyperfine structure.
- Students will acquire knowledge of rotational, vibrational and electronic spectra of molecules in addition to acquaintance with the principle of electron spin and nuclear magnetic resonance, nuclear quadrupole spectroscopy and their applications.
- They will also learn the Laser principle, basic Lasers and its applications.

THEORY

P14x PHY603-History of Science in India

Course Outcomes

- Students will realize and sense the excitement how deeply the mysteries of the starry sky and several socio-cultural aspects of human coexistence with nature have puzzled the great minds of all times in India and motivated them into extensive enquiry.
- Students will learn about the long tradition of the monumental ancient-to-modern wisdom in science contributed by Indian scientists with

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their sheer dedication and intellect despite the obvious lack of adequate resources and experimental facilities.

- They would clearly understand how the scientific ideas progress through the application of mathematics built on reason and logical methods and ultimately lead to scientific revolutions.
- Thus, students will appreciate the role of human observations in verification of the scientific principles and necessity of the technological tools to add to or modify or overturn the already acquired knowledge along the line of history.

THEORY

P14y PHY604-Plasma Physics and Space Science

Course Outcomes

- After completing the course the students will understand the basic concepts of plasma physics and will have very good knowledge of mathematical models for plasma and will be able to distinguish the dynamics of plasmas and neutral fluid media.
- They will be able to describe the propagation of waves in plasmas and will have good insight into plasma instabilities.
- Students will be able to know about the atmospheric structures, the Sun-Earth system and space weather.
- The students will feel a great deal of excitement

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with our current understanding into the mysteries of the stars and universe, especially with the modern state-of-the-art technology like “Hubble Space Telescope” and “Planck” spacecraft.

THEORY

Inorganic Chemistry

PAPER 12

Course outcome

After the completion of the semester student will acquire knowledge

- **CO-1** Semi-modern concepts of metal ligand bonding in coordination complexes
- **CO-2** Inorganic polymers viz. silicones which find applications in materials pharmaceutical industries and surgery too. Phosphazenes which in last couple of years had witnessed significant development as emerging smart materials.
- **CO-3** Class-a and class-b donor-acceptors, symbiotic relationship

THEORY

Quantum Mechanics and Spectroscopy (Physico Organic)

PAPER 13

Course outcome

This course provides students with a detailed knowledge of the fundamental aspects of the subject spectroscopy such as

- **CO-1** Infrared spectroscopy in which characteristic absorptions of various functional groups.

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- CO-2 Ultraviolet absorption spectroscopy, Beer Lambert Law, types of electronic transitions and the effect of conjugation and concept of chromophore and auxochrome.
- CO-3 Nuclear magnetic resonance, interpretation of NMR spectra of simple organic molecule.
- CO-4 Quantum mechanics as well as of spectroscopy. They will have comprehensive understanding of valence bond model and molecular orbital model.

THEORY

Polymer Chemistry (Chemistry Elective 3)

PAPER 14X

Course outcome

Students will learn to:

- CO-1. define related concepts of polymers.
- CO-2. summarize historical evolution of the polymers.
- CO-3. recognize monomers and polymers.
- CO-4. evaluate the structure of polymers.
- CO-5. recognize bonds between polymer chains.
- CO-6. debate thermal character and affecting factors of thermal behaviours.
- CO-7. use determining method of molecular weights.
- CO-8. categorize polymers.
- CO-9. explain polymers production processes.

THEORY

Chemistry of Natural Products (Chemistry Elective 4)

Paper 14Y

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Course Outcome

At the end of the course students will be able to...

- CO1 Learn the different types of alkaloids, steroids, vitamins & terpenes etc and their chemistry and medicinal importance.
- CO2 Explain the importance of natural compounds as lead molecules for new drug discovery.
- CO3 Explain vitamins Chemistry and Physiological significance of Vitamin CO4 Elaborate general methods of structural elucidation of compounds of natural origin.
- CO5 Learn advanced methods of structural elucidation of compounds of natural origin.

Chemistry Minor Project (Chemistry Practical 6)

MP

Course Outcome

After completing the course, the student will be able to: -

- CO-1 Having acquired knowledge to handle instruments and its calibration.
- CO-2 Explain the structure and bonding in molecules / ions and predict the structure of molecules / ions.
- CO-3 Explain selected crystal structures, explain and perform calculations of the lattice enthalpy of ionic compounds.
- CO-4 Having knowledge of Beer Lamberts law
- CO-5 To separate compounds chromatographically.
- CO-6 Able to make solutions accurately to perform conductance experiments.
- CO-7 To understand making circuit connections and taking observations.

THEORY

ADVANCED ALGEBRA

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PAPER 12

Course Outcomes

- Give the structure of an abelian group of a given order.
- Construct the splitting field extension of a given polynomial.
- Understand the interplay of group theory and field theory.
- Determine the minimal polynomial of an algebraic element.

THEORY

Differential Geometry & Tensor Analysis

PAPER 13

Course Outcomes

- Explain the concept of differentiable geometry.
- Understand the concepts of tensors in differentiable geometry.
- Apply various concept of differential calculus in tensors.

THEORY

ADVANCED DIFFERENTIAL EQUATIONS

PAPER 14 A

Course Outcomes

- Solve the system of 1st order differential equations, 2nd order differential equations, nth order differential equations, oscillatory equation, stability and unstability of linear and non-linear system of equations.
- Conceptualize Green's functions and nature of critical

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points.

- Prove advanced understanding of topics in applied mathematics, computational physics etc.

THEORY

OPERATION RESEARCH

PAPER 14 B

COURSE OUTCOMES

- Be able to understand the application of OR and frame a LP Problem with solution
- Be able to build and solve Transportation and Assignment problems using appropriate method.
- Be able to design and solve simple models of CPM and queuing to improve decision making and develop critical thinking and objective analysis of decision problems.
- to take best course of action out of several alternative courses for the purpose of achieving objectives by applying game theory and sequencing models.

MINOR PROJECT