

# SDGI GLOBAL UNIVERSITY



## SCHOOL OF SCIENCES, GHAZIABAD

### Evaluation Scheme & Syllabus For B.Sc. (H) PCM

[Effective from the Session: 2025-2026]  
A.Y-25-26

**SDGI GLOBAL UNIVERSITY, GHAZIABAD**

## **Program Curriculum**

### **B.Sc. Hons. PCM (Effective from Academic Session 2025-26)**

#### **Introductions:**

The Bachelor of Science (Honours) in Physics, Chemistry, and Mathematics (B.Sc. Hons PCM) is a rigorous and intellectually stimulating undergraduate program designed to provide a strong foundation in three of the most fundamental pillars of science. This curriculum is meticulously structured to offer an integrated approach to understanding the principles governing matter, energy, and the abstract concepts of numbers and space, which are at the heart of all scientific advancements.

This program is tailored to nurture scientific temperament, analytical reasoning, quantitative skills, and a research-oriented mindset among students. With Physics exploring the laws of nature, Chemistry uncovering the composition and transformations of substances and Mathematics provide the language and logic for scientific modeling and problem-solving, the B.Sc. (Hons.) PCM course empowers students with a deep and broad understanding of the natural world.

The curriculum emphasizes both theoretical knowledge and practical laboratory skills, ensuring that students are well-prepared for higher education, research, competitive examinations, and a diverse range of professional careers in education, industry, government, and scientific institutions. Through a combination of core courses, discipline-specific electives, ability enhancement, and skill development components, this program aims to cultivate critical thinking, creativity, and a lifelong passion for learning.

As the world increasingly relies on interdisciplinary approaches to solve complex problems, graduates of B.Sc. (Hons.) PCM stand at the forefront of innovation, discovery, and technological advancement, making meaningful contributions to science and society.

### **Programme Educational Objectives (PEO's)**

#### **BSc- (Hons.) in Physics, Chemistry, Mathematics-**

#### **Programme Education Objectives:**

**PEO 1: Proficiency in Core Disciplines-** Graduates will demonstrate a strong foundation in physics, chemistry, and mathematics, encompassing theoretical knowledge and practical skills.

**PEO 2: Problem Solving and Critical Thinking-** Graduates will develop the ability to analyze, evaluate, and solve complex problems using scientific principles and mathematical techniques.

**PEO 3: Research and Innovation-** Graduates will be prepared to engage in scientific research, experimentation, and innovation, contributing to advancements in their respective fields.

**PEO 4: Interdisciplinary Collaboration-** Graduates will possess the skills to collaborate across disciplines, applying knowledge from physics, chemistry, and mathematics to address

real-world challenges and interdisciplinary projects.

### **Programme Outcomes (PO's):**

**PO1: Knowledge and Understanding-** Understanding and applying fundamental principles of physics, chemistry, and mathematics to solve complex problems.

**PO2: Experimental and Analytical Skills-** Design and conduct experiments, analyze data, and interpret results effectively. Utilize computational tools and software for scientific computing and data analysis.

**PO3: Mathematical Proficiency-** Demonstrate proficiency in mathematical methods including calculus, differential equations, linear algebra, and discrete mathematics.

**PO4: Communication Skills-** Communicate scientific concepts clearly through written reports, oral presentations, and graphical representations.

**PO5: Interdisciplinary Collaboration-** Collaborate effectively in interdisciplinary teams to address real-world challenges.

**PO6: Ethical and Professional Conduct-** Demonstrate ethical behavior, integrity, and professionalism in scientific research and practice.

**PO7: Lifelong Learning and Professional Development-** Commit to lifelong learning and professional development to stay updated with advancements in science and technology.

**PO8: Career Readiness-** Pursue further studies or careers in research, academia, industry, engineering, finance, or technology.

### **Programme Specific Outcomes (PSO):**

#### **Physics:**

**PSO 1:** Apply principles of classical mechanics, electromagnetism, thermodynamics, and quantum mechanics to analyze and solve physical problems.

**PSO 2:** Utilize mathematical methods and computational tools to model physical phenomena and predict outcomes.

**PSO 3:** Design and conduct experiments, as well as analyze and interpret data, in various branches of physics.

**PSO 4:** Demonstrate proficiency in theoretical and experimental aspects of specialized areas such as condensed matter physics, particle physics, or astrophysics

### **Chemistry:**

**PSO 1:** Apply principles of organic and inorganic chemistry, physical chemistry, and analytical chemistry to understand chemical phenomena and reactions.

**PSO 2:** Perform laboratory experiments, analyze chemical substances, and interpret spectroscopic data using appropriate techniques.

**PSO 3:** Design and synthesize novel compounds, materials, or molecules for specific applications in fields such as pharmaceuticals, materials science, or environmental chemistry.

**PSO 4:** Apply theoretical concepts and computational methods to predict chemical properties, molecular structures, and reaction mechanisms.

### **Mathematics:**

**PSO 1:** Apply mathematical techniques and methods to solve problems in diverse areas such as calculus, differential equations, linear algebra, and discrete mathematics.

**PSO 2:** Utilize mathematical modelling and computational methods to analyze and interpret data, optimize systems, and predict outcomes.

**PSO 3:** Apply mathematical reasoning and abstraction to formulate and solve real-world problems in various fields such as engineering, physics, economics, and computer science.

**PSO 4:** Develop proficiency in specialized areas of mathematics such as numerical analysis, mathematical physics, or operations research.

**Course Status system: Every** course will be coded as follows:

<b>Abbreviations</b>	<b>Subject Category/status</b>
DSC (Core/Major)	Discipline Specific Course (Core/Major)
DSE (Elective /Minor)	Discipline Specific Course Elective /(Minor)
OE OR GE	Interdisciplinary course/Multidisciplinary/OE/GE
AEC	Ability Enhancement Compulsory Courses
SEC	Skill Enhancement Courses
VAC	Value Addition Courses
Dissertation	Dissertation
Project	Project
Internship	Internship

# SDGI GLOBAL UNIVERSITY, GHAZIABAD



## SCHOOL OF SCIENCES

### EVALUATION SCHEME FOR BACHELOR OF SCIENCE

#### DEPARTMENT OF PHYSICAL SCIENCES (PCM)

#### BRANCH: - B.Sc. (H)PCM as per NEP 2020

#### SESSION - 2025-26

#### SEMESTER - 1st

S. No	Status	Subject Code	Subject Name	Hours	Credits			Passing Marks	Total Marks
						IN	EX		
						Total	Total		
1	DSC (Core/Major)	B100724101	Mechanics & Properties of Matter	3	3	50	50	40	100
2	DSC (Core/Major)	B100724102	Basic of Inorganic	3	3	50	50	40	100
3	DSE (Elective /Minor)	B100724103	Calculus	3	3	50	50	40	100
4	GE	B10GE2401	Entrepreneurship and IPR	3	3	50	50	40	100
5	AEC	BSGUAE2401	English Language Proficiency	2	2	50	50	40	100
6	VAC	BSGUVA2404	Introduction to Indian Constitution	3	3	50	50	40	100
7	SEC	BSGUSE2410	Office Automation	2	2	25	25	20	50
8		BSGUSE2460	Office Automation-Lab	2	1	30	20	20	50
9	Practical	B100724151P	Mechanics & Properties of Matter Lab	2	1	60	40	40	100

10	Practical	B100724152 P	Basic of Inorganic Lab	2	1	60	40	40	100
			*Courses host By SWAYAM		3				
					25				900

### SEMESTER - 2nd

S. No	Status	Subject Code	Subject Name	Hou rs	Credi ts			Passin g Mark s	Total Mar ks
						Total	Total		
						Total	Total		
1	DSC (Core/Major)	B100724201	Electricity and Magnetism	3	3	50	50	40	100
2	DSC (Core/Major)	B100724202	Basics of Organic Chemistry	3	3	50	50	40	100
3	DSE (Elective /Minor)	B100724203	Differential Equations	3	3	50	50	40	100
4	GE	B10GE2402	Research methodology And Bioethics	3	3	50	50	40	100
5	AEC	BSGUAE240 4	Professional Communicati on	2	2	50	50	40	100
6	VAC	BSGUVA24 01	Environmenta l Education	3	3	50	50	40	100
7	SEC	BSGUSEC24 12	Soft Skills	2	2	25	25	20	50
8		BSGUVA24 62	Soft Skills	2	1	30	20	20	50
9	Practical	B100724251 P	Electricity and Magnetism Lab	2	1	60	40	40	100
10	Practical	B100724252 P	Basics of Organic Chemistry lab	2	1	60	40	40	100
			*Courses host By SWAYAM		3				
					25				900

### SEMESTER - 3rd

S. No	Status	Subject Code	Subject Name	Hours	Credits			Passing Marks	Total Marks
						Total	Total		
1	DSC (Core/Major)	B100724301	Elements of Modern Physics	3	3	50	50	40	100
2	DSC (Core/Major)	B100724302	Chemistry of s & p block elements	3	3	50	50	40	100
3	DSC (Core/Major)	B100724303	Real Analysis	4	4	50	50	40	100
4	GE	B10GE2413	Cognitive Psychology	3	3	50	50	40	100
5	AEC	BSGUAE2405	Research Writing Skills	2	2	50	50	40	100
6	SEC	BSGUSE2413	Reasoning & aptitude learning	2	2	25	25	20	50
7		BSGUSE2463	Reasoning & aptitude learning Practical	2	1	30	20	20	50
8	Practical	B100724351 P	Elements of Modern Physics Lab	2	1	60	40	40	100
9	Practical	B100724352 P	Chemistry of s & p block elements Lab	2	1	60	40	40	100
			*Courses host By SWAYAM		3				
					23				900

### SEMESTER - 4th

S. No	Status	Subject Code	Subject Name	Hours	Credits			Passing Marks	Total Marks
						Total	Total		
1	DSC (Core/Major)	B100724401	Solid State Physics	4	4	50	50	40	100

2	DSC (Core/Major)	B100724402	Solutions, Conductance, Electrochemistry	4	4	50	50	40	100
3	DSC (Core/Major)	B100724403	Linear Algebra	4	4	50	50	40	100
4	DSE (Elective /Minor)	B100724404	Group Theory -I	3	3	50	50	40	100
5	AEC	BSGUAE240 6	Team building & Leadership	2	2	50	50	40	100
6	Practical	B100724451 P	Linear Algebra lab	2	1	60	40	40	100
7	Practical	B100724452 P	Solid State Physics Lab	2	1	60	40	40	100
8	Practical	B100724453 P	Electrochemis try -Lab	2	1	60	40	40	100
			*Courses host By SWAYAM		3				
					<b>23</b>				<b>900</b>

**Course Status system: Every course will be coded as follows:**

<b>Abbreviations</b>	<b>Subject Category/status</b>
<b>DSC (Core/Major)</b>	<b>Discipline Specific Course (Core/Major)</b>
<b>DSE (Elective /Minor)</b>	<b>Discipline Specific Course Elective /(Minor)</b>
<b>OE OR GE</b>	<b>Interdisciplinary course/Multidisciplinary/OE/GE</b>
<b>AEC</b>	<b>Ability Enhancement Compulsory Courses</b>
<b>SEC</b>	<b>Skill Enhancement Courses</b>
<b>VAC</b>	<b>Value Addition Courses</b>
<b>Dissertation</b>	<b>Dissertatio n</b>
<b>Project</b>	<b>Project</b>
<b>Internsh ip</b>	<b>Internship</b>

\* SWAYAM based on online credit courses.- SWAYAM is a programme initiated by Government of India and designed to achieve the three cardinal principles of Education Policy viz., access, equity and quality. The objective of this effort is to take the best teaching learning resources to all, including the most disadvantaged.

SWAYAM seeks to bridge the digital divide for students who have hitherto remained untouched by the digital revolution and have not been able to join the mainstream of the knowledge economy. (1) The schedule of the SWAYAM based online credit courses shall be aligned with the conventional education semester commencing in the month of January and July of every year. (2) The SWAYAM based online credit courses shall be developed, delivered and assessed only by the course-coordinator. (3) The course and course-coordinator shall be identified by the National Coordinator in accordance with the SWAYAM guidelines with the prior approval of the SWAYAM Board. (4) The course-coordinator shall offer the SWAYAM based online credit courses through the Host Institution which shall issue the certificate with grades after the end term proctored examination for credit transfer. (5) The list of SWAYAM based online credit courses for the ensuing semester shall be notified on the SWAYAM platform before the 1st November for the January semester and before the 1st June for the July semester, every year.

**CONTENT  
1<sup>ST</sup> SEMESTER**

## **Mechanics and Properties of Matter (B100724101)**

<b>School Name- School of Science</b>			
<b>Program- B.Sc (H) PCM</b>			<b>Semester- 1st</b>
<b>Course Name- Mechanics and Properties of Matter</b>			
<b>A.Y 2025-26</b>	<b>Course Code- B100724101</b>	<b>Batch- 2025- 29</b>	<b>CIE Marks- 50 MM</b>
<b>Total Teaching Hours - 45</b>	<b>Total Credits- 3-0-0</b>		<b>ESE Marks- 50 MM</b>
<b>Type of Course- Theory</b>			<b>Total Marks 100 MM</b>
<b>Course Objectives</b>			
<p>The course on Mechanics and Properties of Matter aims to provide students with a fundamental understanding of the behavior of physical systems, both in terms of mechanical motion and in terms of the properties of matter</p>			
<b>Course Description</b>			
<p>The students will be introduced to forces, angular momentum, velocity and acceleration. The course provides the students about the knowledge of moment of inertia and centre of mass. Students will be able to articulate and describe relative motion, Inertial and non-inertial frames, Newton's laws of motion, conservation laws, hydrodynamics and elasticity of the materials.</p>			
<b>UNIT</b>	<b>Topics</b>		<b>No. of Teaching hours/ (Lecture)</b>
<b>1</b>	<b>Introduction to Newtonian Mechanics</b>  Displacement, velocity, acceleration of particle mass; Displacement–time graph, velocity–time graph, acceleration–time graph; Velocity and acceleration in Cartesian, Plane Polar and Cylindrical Polar systems; Newton's laws of motion, Frame of reference– Inertial and Non-inertial frame of reference, concept of force, momentum, impulse, laws of		<b>9</b>

	impact, direct impact between two smooth spheres, reduced mass, numerical problems	
<b>2</b>	<b>System of Particles &amp; Rigid Body Dynamics</b> System of particles – Centre of mass (CM), Equation of motion of the CM, Conservation of linear momentum, angular momentum, and energy; System of variable mass – The rocket; Compound pendulum – theory – Equivalent simple pendulum – reversibility of centre of oscillation and suspension – determination of g and k.	<b>9</b>
<b>3</b>	<b>Hydrodynamics</b> Laminar or viscous flow, Viscosity: Newton’s law of viscous flow – Coefficient of viscosity; Kinematics of moving fluids – equation of continuity, Bernoulli’s theorem, Euler’s equation, applications of Bernoulli’s theorem – Venturimeter, Velocity of efflux of a liquid– Torricelli’s theorem; Streamline and turbulent motion – critical velocity, Poiseuille’s formula– flow of a liquid through a horizontal narrow tube, Variation of viscosity with temperature. Surface tension – angle of contact – shape of liquid meniscus in a capillary tube; Excess pressure, Variation of Surface Tension with temperature, Determination of S.T by Jaeger’s method	<b>10</b>
<b>4</b>	<b>Elasticity</b> Load, stress & strain – Hooke’s law, Stress strain diagram, Elastic moduli – relations connecting the elastic constants, Poisson’s ratio – limiting values of Poisson’s ratio, Work done in stretching and twisting a wire, twisting couple on a cylinder, Rigidity modulus by static torsion, Torsional pendulum – rigidity modulus and moment of inertia	<b>9</b>
<b>5</b>	<b>Gravitation and Central Force Motion</b> Law of gravitation, Gravitational potential energy, Potential and field due to spherical shell and solid sphere, Motion of a particle under a central force field, Two-body problem and its reduction to one-body problem and its solution, Differential Equation of motion with central force and its solution, Keplers Laws of Planetary motion, Satellites:. Geosynchronous orbits, Weightlessness, Basic idea of global positioning system (GPS), Physiological effects on astronauts.	<b>8</b>

#### Course Outcomes

**CO1** Students will be able to understand about Introduction to Newtonian Mechanics.

**CO2** Students will be able to gain brief knowledge on System of Particles & Rigid Body Dynamics

**CO3** Students will be able to achieve the brief knowledge on Hydrodynamics including surface tension, viscosity etc.

**CO4** Students will be able to explain the phenomena related to Elasticity including different rigidity modulus.

**CO5** Students will be able to capture the basic knowledge on Gravitation and Central Force Motion.

**Text books:**

1. BrijLal and N. Subramaniam (1994). Properties of Matter (6th edn), S. Chand & Co., New Delhi, ISBN no. 9788121902809
2. R. Murugesan (2001). Properties of Matter (5th edn), S. Chand & Co., New Delhi, ISBN no. 9788121906050

**Reference books:**

1. Narayanamoorthy (2001), Mechanics – Part I and II, National Publishing Company.
2. D.S. Mathur (2001). Mechanics (2nd edn), S. Chand & Co.
3. Arthur Beiser, Shobhit Mahajan, S. Rai Choudhury (2003). Concepts of Modern Physics (6<sup>th</sup> edn), Tata McGraw-Hill, ISBN no. 9780070151550
4. Murugesan (2001). Modern Physics (11th edn), S. Chand & Co., New Delhi, ISBN no. 978-81-219-0320-2
5. Hemendralal Chatterjee and Ratneswar Sengupta, A Treatise on General Properties of Matter, New Central Book Agency (P) Limited, New Delhi, ISBN: 9788173811746
6. Introduction to Mechanics Daniel Klappner and Robert Kolenkow, McGrawHill.
7. Physics, Resnick, Halliday and Walker (8/e.2008,Wiley)

**Assessment method:** (Continuous Internal Assessment = 50%, Final Examination = 50%)

## Mechanics and Properties of Matter Lab (B100724151P)

<b>School Name- School of Science</b>			
<b>Program- B.Sc (H) PCM</b>			<b>Semester- 1st</b>
<b>Course Name- Mechanics and Properties of Matter Lab</b>			
<b>A.Y 2025-26</b>	<b>Course Code- B100724151P</b>	<b>Batch- 2025-29</b>	<b>CIE Marks- 60 MM</b>
<b>Total Teaching Hours - 30</b>	<b>Total Credits- 0-0-1</b>		<b>ESE Marks- 40 MM</b>
<b>Type of Course- Practical</b>			<b>Total Marks 100 MM</b>
<b>List of Experiments</b>			
<ol style="list-style-type: none"> <li>1. To determine the acceleration due to gravity 'g' by Bar Pendulum.</li> <li>2. To determine the value of 'g' at SDGI University using a Kater's Pendulum (reversible pendulum)</li> <li>3. Determination of the moment of inertia of a fly-wheel about its axis of</li> </ol>			

	rotation by Falling Weight Method <b>4.</b> To determine the modulus of rigidity of material of given wire by dynamical method using Maxwell needle <b>5.</b> To determine the rigidity modulus of the suspension wire using torsion pendulum. <b>6.</b> To find the Young modulus of the given material bar by non-uniform bending using pin and microscope method <b>7.</b> Determination of Young modulus by using Searle method. <b>8.</b> To Study the Relation between Frequency and Length of a Given Wire under Constant Tension Using Sonometer <b>9.</b> To determine the coefficient of viscosity of a given viscous liquid by measuring the terminal velocity of a given spherical body <b>10.</b> Determination of coefficient of viscosity of liquid by Mercury pellet method. <b>11.</b> Determination of surface tension by drop weight method	
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**Text Books:**

1. D. Chattopadhyay, P.C. Rakshit, and B. Saha (2002). An Advanced Course in Practical Physics (6<sup>th</sup> edn), Books and Allied, Kolkata, ISBN no: 8187134208.
2. Balasubramanian. S, Ranganathan. R, Srinivasan M.N (2017). A Textbook of Practical Physics (2<sup>nd</sup> edn), S. Chand and Sons Pvt. Ltd, ISBN no: 81-8054-744-7
3. C.C. Ouseph, U.J. Rao, V. Vijayendran (2015). Practical Physics (1st edn), Viswanathan. S Printers and Publishers Pvt. Ltd., ISBN-13: 978-8187156215

**Reference Books:**

1. C.L. Arora (1985). B.Sc. Practical Physics (1st edn) Chand Publishing, ISBN no: 9788121909099
2. P.R. Sasi Kumar (2011). Practical Physics (1st edn), PHI Learning Pvt. Ltd, Delhi, ISBN no: 9788120344341

## **Basics of Inorganic Chemistry (B100724102)**

<b>School Name- School of Sciences</b>			
<b>Program-B.Sc (H) PCM</b>		<b>Semester- Ist</b>	
<b>Course Name- Basics of Inorganic Chemistry</b>			
<b>A.Y- 2025-26</b>	<b>Course Code- B100724102</b>	<b>Batch-2025-29</b>	<b>CIE Marks-50 MM</b>
<b>Total Teaching Hours-45</b>	<b>Total Credits- 3-0-0</b>		<b>ESE Marks-50 MM</b>
<b>Type of Course- Theory</b>			<b>Total Marks-100 MM</b>

**Course Objectives: -**

In organic chemistry course objectives typically focus on building a foundational understanding of chemical principles, specifically relating to the structure, bonding and reactivity of inorganic compounds.

**Course Description: -**

Inorganic chemistry courses generally cover the principles of atomic structures, bonding and reactivity with a focus on non-carbon-based compounds.

<b>UNIT</b>	<b>Topics</b>	<b>No. of Teaching hours/ (Lecture)</b>
<b>1</b>	<b>Atomic Structure</b> Bohr's theory & its limitations, atomic spectrum of hydrogen atom, Wave mechanics: De Broglie equation, Heisenberg's uncertainty principle and its significance, Schrödinger's wave equation and significance of $\psi$ and $\psi^2$ . Quantum numbers and their significance. Shapes of s, p, d and f orbitals. Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau's Principle and its limitations.	<b>10</b>
<b>2</b>	<b>Periodicity of Elements</b> Long form of periodic table, classification of elements (s, p, d, f block elements), Detailed discussion of the following properties of the elements, with reference to s & p-block. Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table. Atomic radii (Vander Waals), Ionic, Crystal and covalent radii. Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Application of ionization enthalpy. Electron gain enthalpy, trends of electron gain enthalpy. Electronegativity: Variation of electronegativity with bond order, partial charge, hybridization, group electronegativity.	<b>10</b>
<b>3</b>	<b>Chemical Bonding I</b> Ionic bond: Definition, factors influencing the ionic bond- Ionization energy, Electron affinity & Lattice energy. Covalent bond: Lewis structure, Valence Bond Theory (Heitler- London approach), Molecular Orbital Theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N <sub>2</sub> , O <sub>2</sub> , C <sub>2</sub> , B <sub>2</sub> , F <sub>2</sub> , CO, NO. Valence Shell Electron Pair Repulsion Theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons.	<b>9</b>
<b>4</b>	<b>Chemical Bonding II</b> Covalent character in ionic compounds, polarizing power and	<b>9</b>

	polarizability. Fajan's rules and consequences of polarization. Ionic character in covalent compounds: Metallic Bond: Qualitative idea of valence bond and band theories. Weak chemical forces: Vander Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces, hydrogen bonding (theories of hydrogen bonding, valence bond treatment) Effects of chemical force, melting and boiling points.	
<b>5</b>	<b>Oxidation-Reduction</b> Oxidation, reduction, oxidising agent, reducing agent, oxidation number and calculation of oxidation number of elements in compounds. Redox equations, standard electrode potential and its application to inorganic reactions. Redox titrations.	<b>7</b>

**Course Outcomes (COs):**

**CO1:** Acquire knowledge about the basics concepts of Inorganic Chemistry for assessing in social welfare.

**CO2:** Identify the common themes running through ionic, covalent, and metallic descriptions of chemical bonding for the effective lifelong learning.

**CO3:** Apply the knowledge of s, p, d, f block elements of periodic table with their atomic properties for the utilization in the social issues.

**CO4:** Interpret the concept of the redox reactions as well the oxidation state of the atoms in compounds.

**CO5:** Formulate and solve chemical problems to manage projects in multidisciplinary environment.

**Suggested Readings:**

1. Lee, J.D. Concise Inorganic Chemistry, Wiley publications.
2. Cotton, F Alb, Advanced Inorganic Chemistry, Wiley publications
3. Agarwal, S.K, Advanced Inorganic Chemistry, Pragati publications.
4. Satya Prakash, Advanced Inorganic Chemistry, S. Chand publications

**Assessment method:** (Continuous Internal Assessment = 50%, Final Examination = 50%)

**Basics of Inorganic Chemistry Lab (B100724152P)**

<b>School Name- School of Sciences</b>			
<b>Program-B.Sc (H) PCM</b>			<b>Semester- Ist</b>
<b>Course Name- Basics of Inorganic Chemistry Lab</b>			
<b>A.Y—2025-26</b>	<b>Course Code B100724152P</b>	<b>Batch-2025-29</b>	<b>CIE Marks- 60 MM</b>
<b>Total Teaching Hours- 30</b>	<b>Total Credits- 0-0-1</b>		<b>ESE Marks- 40 MM</b>
<b>Type of Course- Practical</b>			<b>Total Marks- 100 MM</b>
<b>Objectives of the Course:</b>			
<ol style="list-style-type: none"> <li>1. To provide basic concepts and experimental knowledge in field of Inorganic Chemistry.</li> <li>2. To familiarize students with analysis of different cations, anions, interfering radicals etc.</li> <li>3. To provide knowledge about volumetric analysis, water analysis etc.</li> <li>4. To prepare standard solutions according to varying normality, molality etc</li> </ol>			
<b>Practicals:- Any 10 practical to be performed</b>			
<ol style="list-style-type: none"> <li>1. Calibration of Analytical Equipment and apparatus.</li> <li>2. Determination of Alkalinity of water sample.</li> <li>3. Determination of Hardness of water sample by EDTA method.</li> <li>4. Determination of chloride content in water sample.</li> <li>5. Determination of available chlorine in bleaching powder.</li> <li>6. Determination of pH by titrimetric method.</li> <li>7. Determination of surface tension of given liquid.</li> <li>8. Determination of Viscosity of a given liquid by viscometer.</li> <li>9. To prepare standard solutions of given morality.</li> <li>10. To prepare standard solutions of given normality.</li> <li>11. To identify the acid radicals in given sample.</li> <li>12. To identify the basic radicals in given sample.</li> </ol>			
<b>Suggested Readings:</b>			
<ol style="list-style-type: none"> <li>1. Vogel's Qualitative Inorganic Analysis, Revised by G. Svehla.</li> </ol>			

## Calculus (B100724103)

<b>School Name- School of Sciences</b>			
<b>Program-B.Sc (H) PCM</b>			<b>Semester- Ist</b>
<b>Course Name- Calculus</b>			
<b>A.Y- 2025-2026</b>	<b>Course Code B100724103</b>	<b>Batch- 2025-29</b>	<b>CIE Marks- 50 MM</b>
<b>Total Teaching Hours- 45</b>	<b>Total Credits- 3-1-0</b>		<b>ESE Marks- 50 MM</b>
<b>Type of Course- Theory</b>			<b>Total Marks- 100 MM</b>
<b>Course Objectives: -</b>			
<ol style="list-style-type: none"> <li>1. Students will be exposed to computational technique and application of differentiation &amp; integral the objective is to develop a competent working knowledge of the main concept and method introduced.</li> <li>2. Students will find the application of the topic applicable in physical sciences and engineering.</li> </ol>			
<b>UNIT</b>	<b>Topics</b>		<b>No. of Teaching hours/ (Lecture)</b>
<b>1</b>	<b>Successive Differentiation and Curve tracing</b>  Successive Differentiation, Leibniz rule, Rolle's Mean value theorem, Lagrange's mean value theorem, Cauchy mean value theorem, asymptotes: - condition of existence of asymptote, parallel to axes & alternative approach, curve tracing in Cartesian coordinates.		<b>10</b>
<b>2</b>	<b>Definite Integration and Multiple Integral</b>  Definite integral and Properties of Definite integral, Application of Integration; Double integration, evaluation of double integrals in polar co-ordinates, Area in Cartesian co-ordinates, Area in polar co-ordinates, Change of order in double integrals and triple integrals, integration by change of Cartesian coordinate into spherical coordinate, Volume of solid bounded by sphere or by cylinder, Dirichlet's integral, liouville's extension of Dirichlets theorem.		<b>13</b>

<b>3</b>	<b>Partial Differentiation</b> Partial Differentiation, Euler's Theorem on Homogeneous Function, Tangent planes and Increment Approximation, Total differential coefficient	<b>5</b>
<b>4</b>	<b>Extreme of Functions of Several variables</b> Maxima and Minima of function of two variable, Extreme of Functions of Several Variables, Lagrange Multipliers method, Beta and Gamma functions and their properties.	<b>7</b>
<b>5</b>	<b>Vector Calculus</b> Derivative of vector valued functions, Velocity, Acceleration and related problems, Scalar and Vector point functions. Definition of Gradient, Divergence and Curl-problems. Solenoidal and Irrotational vector fields. Vector identities - $\text{div}(\phi A)$ , $\text{curl}(\phi A)$ , $\text{curl}(\text{grad } \phi)$ , $\text{div}(\text{curl } A)$ .	<b>10</b>

**Course Objectives: -**

1. Student will learn to find successive differentiation and apply Leibniz rule for finding higher order and learn to find concavity and point of inflexion of the curve, tracing of curve in Cartesian coordinate, indeterminate forms.
2. Students will be able to work with parametric equation and their representation and will learn about definite integral and application of integration and find the area of a plane region between two curves, area of a surface of revolution.
3. Students will be able to understand the concept of partial differentiation and learn about increment approximation, total differential and Jacobean.
4. Students will be able to find the maxima and minima of function of several variables and learn the Lagrange multipliers method for finding extreme of function.
5. Students will learn to solve double and triple integral, change of order in double integral and understand beta and gamma functions.

**Text Books:**

1. Gorakh Prasad, Differential Calculus, Pothishala Private Ltd. Allahabad.
2. Gorakh Prasad, Integral Calculus, Pothishala Private Ltd. Allahabad.

**Reference Books:**

1. G.B. Thomas and R.L. Finney, *Calculus*, Pearson Education, Delhi.
2. M.J. Strauss, G.L. Bradley and K. J. Smith, *Calculus*, Dorling Kindersley (India) P. Ltd. (Pearson Education), Delhi.
3. H. Anton, I. Bivens and S. Davis, *Calculus*, John Wiley and Sons (Asia) P. Ltd., Singapore.
4. R. Courant and F. John, *Introduction to Calculus and Analysis* (Volumes I & II), Springer-Verlag, New York, Inc.

5. M.J. Strauss, GL Bradley and KG smith, calculus, dolling Kindersley (India) pt. Limited  
Pearson education, Delhi 2007

**Assessment method:** (Continuous Internal Assessment = 50%, Final Examination = 50%)

2<sup>ND</sup> SEMESTER

## Electricity and Magnetism (B100724201)

School Name- School of Science			
Program- B.Sc (H) PCM			Semester- 2nd
Course Name- Electricity and Magnetism			
A.Y 2025-26	Course Code- B100724201	Batch- 2025- 29	CIE Marks- 50 MM
Total Teaching Hours 45	Total Credits- 3-0-0		ESE Marks- 50 MM
Type of Course- Theory			Total Marks 100 MM
<b>Course Objectives</b> Students will be able to improve their basic understanding of electricity and magnetism subject by solving problems on various topics in electrostatics, magnetostatics and electrodynamics			
<b>Course Description</b> The course on Electricity and Magnetism aims to provide students with a fundamental understanding of the principles of electricity, magnetism, and their interactions.			
UNIT	Topics		No. of Teaching hours/ (Lecture)
1	<b>Electric Field and Electric Potential</b> Electric field: Electric field lines, Electric flux, Gauss's Law with applications to charge distributions with spherical, cylindrical and planar symmetry. Conservative nature of Electrostatic Field. Electrostatic Potential Laplace's Potential and Electric Field of a dipole. Force and Torque on a dipole. Electrostatic energy of system of charges. Electrostatic energy of a charged sphere. Conductors in an electrostatic Field. Surface charge and force on a conductor. Capacitance of a system of charged conductors. Parallel-plate capacitor. Capacitance of an isolated conductor. Method of Images and its application to :(1) Plane Infinite Sheet and (2) Sphere.		10
2	<b>Dielectric Properties of Matter</b> Electric Field in matter. Polarization, Polarization Charges. Electrical Susceptibility and Dielectric Constant. Capacitor (parallel plate, spherical,		8

	cylindrical) filled with dielectric. Displacement vector <b>D</b> . Relations between <b>E</b> , <b>P</b> and <b>D</b> . Gauss' Law in dielectrics.	
<b>3</b>	<b>Magnetic Field</b> Magnetic force between current elements and definition of Magnetic Field <b>B</b> . Biot-Savart's Law and its simple applications: straight wire and circular loop. Current Loop as a Magnetic Dipole and its Dipole Moment (Analogy with Electric Dipole). Ampere's Circuital Law and its application to (1) Solenoid and (2) Toroid. Properties of <b>B</b> : curl and divergence. Vector Potential. Magnetic Force on (1) point charge (2) current carrying wire (3) between current elements. Torque on a current loop in a uniform Magnetic Field.	<b>8</b>
<b>4</b>	<b>Magnetic Properties of Matter &amp; Electromagnetic Induction</b> Magnetization vector ( <b>M</b> ). Magnetic Intensity( <b>H</b> ). Magnetic Susceptibility and permeability. Relation between <b>B</b> , <b>H</b> , <b>M</b> . Ferromagnetism. B-H curve and hysteresis. Faraday's Law. Lenz's Law. Self Inductance and Mutual Inductance. Reciprocity Theorem. Energy stored in a Magnetic Field. Introduction to Maxwell's Equations. Charge Conservation and Displacement current	<b>9</b>
<b>5</b>	<b>Electrical Circuits &amp; Network theorems</b> AC Circuits: Kirchhoff's laws for AC circuits. Complex Reactance and Impedance. Series LCR Circuit: (1) Resonance, (2) Power Dissipation and (3) Quality Factor, and (4) Band Width. Parallel LCR Circuit Ideal constant-voltage and constant-current Sources. Review of Kirchhoff's Current Law & Kirchhoff's Voltage Law. Mesh & Node Analysis. Thevenin theorem, Norton theorem, Superposition theorem, Reciprocity Theorem, Maximum Power Transfer theorem. Applications to dc circuits.	<b>10</b>

### Course Outcomes

**CO 1** Students will be able to demonstrate phenomenon of electric field and potential to solve a variety of problems.

**CO 2** Students will gain knowledge on electric current, resistance and capacitance in terms of electric field and electric potential. Demonstrate a working understanding of capacitors.

**CO 3** Students will be able to describe the magnetic field produced by magnetic dipoles and electric currents. Also list examples where its effects are observed.

**CO 4** Students will be able to explain Faraday-Lenz and Maxwell laws to articulate the relationship between electric and magnetic fields. Also give basic understanding of magnetic properties of matter.

**CO 5** Students will be able to apply Kirchhoff's rules to analyze AC circuits. They will be also able to apply various network theorems and their applications in electronics, electrical circuit analysis, and electrical machines.

### Text books:

1. S. Mahajan and Choudhury Electricity, Magnetism & Electromagnetic Theory, Tata Mc Graw Hill

**Reference books:**

1. Edward M. Purcell, Electricity and Magnetism, McGraw-Hill Education
2. D.J. Griffiths, Introduction to Electrodynamics, Benjamin Cummings.
3. R.P. Feynman, R.B. Leighton, M. Sand, Feynman Lectures Vol.2, Pearson Education.
4. J.H. Fewkes & J. Yarwood, Electricity and Magnetism, Vol. I, Oxford Univ. Press.

**Assessment method:** (Continuous Internal Assessment = 50%, Final Examination = 50%)

## Electricity and Magnetism Lab (B100724251P)

School Name- School of Science			
Program- B.Sc. (H) PCM			Semester- 2nd
Course Name- Electricity and Magnetism Lab			
A.Y 2025-26	Course Code- B100724251P	Batch- 2025- 29	CIE Marks- 60 MM
Total Teaching Hours 30	Total Credits- 1-0-0		ESE Marks- 40 MM
Type of Course- Practical			Total Marks 100 MM
	List of Experiments		
	<i>At least 6 experiments from the following</i> <ol style="list-style-type: none"><li>1. To study the characteristics of a series RC Circuit.</li><li>2. To determine an unknown Low Resistance using Potentiometer.</li><li>3. To determine an unknown Low Resistance using Carey</li></ol>		

	<p>Foster's Bridge.</p> <ol style="list-style-type: none"> <li>4. To compare capacitances using De'Sauty's bridge.</li> <li>5. Measurement of field strength B and its variation in a solenoid (determine dB/dx)</li> <li>6. To verify the Thevenin and Norton theorems.</li> <li>7. To verify the Superposition, and Maximum power transfer theorems.</li> <li>8. To determine self inductance of a coil by Anderson's bridge.</li> <li>9. To study response curve of a Series LCR circuit and determine its (a) Resonant frequency, (b) Impedance at resonance, (c) Quality factor Q, and (d) Band width.</li> <li>10. To study the response curve of a parallel LCR circuit and determine its (a) Anti- resonant frequency and (b) Quality factor Q.</li> <li>11. Measurement of charge sensitivity, current sensitivity and CDR of Ballistic Galvanometer</li> <li>12. Determine a high resistance by leakage method using Ballistic Galvanometer.</li> <li>13. To determine self-inductance of a coil by Rayleigh's method.</li> <li>14. To determine the mutual inductance of two coils by Absolute method.</li> </ol>	
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**Reference Books:**

1. B.L. Flint and H.T. Worsnop, Advanced Practical Physics for students, Asia Publishing House
2. I.Prakash & Ramakrishna, A Text Book of Practical Physics, 11th Ed., Kitab Mahal
3. Michael Nelson and Jon M. Ogborn, Advanced level Physics Practicals, 4th Edition, reprinted, Heinemann Educational Publishers
4. S.Panigrahi and B.Mallick, Engineering Practical Physics, Cengage Learning.

## **Basics of Organic Chemistry (B100724202)**

<b>School Name- School of Sciences</b>			
<b>Program- B.Sc (H) PCM</b>			<b>Semester- 2nd</b>
<b>Course Name:- Basics of Organic Chemistry</b>			
<b>A.Y- 2025-26</b>	<b>Course Code- B100724202</b>	<b>Batch- 2025-29</b>	<b>CIE Marks- 50 MM</b>

<b>Total Teaching Hours- 45</b>	<b>Total Credits-3-0-0</b>	<b>ESE Marks- 50 MM</b>
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<b>Type of Course- Theory</b>	<b>Total Marks- 100 MM</b>
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**Course Objective:**

To develop a foundational understanding of organic chemistry, focusing on the structure, properties, nomenclature, and basic reactions of organic compounds, preparing students for advanced studies in chemistry, biology, medicine, and related scientific fields.

**Course Description:**

This course introduces essential concepts of organic chemistry, including bonding, molecular structure, functional groups, isomerism, and reaction mechanisms. Students will gain the knowledge and skills necessary to analyze and understand organic compounds in both academic and real-world contexts.

<b>UNIT</b>	<b>Topics</b>	<b>No. of Teaching hours/ (Lecture)</b>
<b>1</b>	<b>Basics of Organic Chemistry</b>  Organic Compounds: Classification and nomenclature, hybridization, shapes of molecules, influence of hybridization on bond properties. Electronic displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications, dipole moment. Organic acids and bases, their relative strength. Homolytic and heterolytic fission with suitable examples. Curly arrow rules, formal charges. Electrophiles and nucleophiles, nucleophilicity and basicity. Relative stability of carbocations, carbanions, free radicals and carbenes. Introduction to types of organic reactions and their mechanism: Addition, elimination and substitution reactions.	<b>10</b>
<b>2</b>	<b>Stereochemistry</b>  Fischer Projection, Newmann and Sawhorse Projection formulae and their interconversions, Geometrical isomerism: cis-trans and, syn-anti isomerism E/Z notations with C.I.P rules. Optical Isomerism: Optical activity, specific rotation, chirality/asymmetry, enantiomers. Molecules with two or more chiral-centres. Distereoisomers, meso structures, racemic mixture and resolution. Relative and absolute configuration: D/L and R/S designations.	<b>9</b>
<b>3</b>	<b>Chemistry of Aliphatic Hydrocarbons</b>  Carbon-Carbon sigma bonds: Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reaction, Free radical substitutions: Halogenation -relative reactivity and selectivity. Carbon-Carbon pi bonds: Formation of alkenes and alkynes by	<b>10</b>

	<p>elimination reactions. Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations.</p> <p>Reactions of alkenes: Electrophilic additions their mechanisms (Markownikoff/ Anti Markownikoff addition), mechanism of oxymercuration-demercuration, hydroboration oxidation, ozonolysis, reduction (catalytic and chemical), syn and anti-hydroxylation(oxidation). 1,2-and 1,4-addition reactions in conjugated dienes and, Diels- Alder reaction, Reactions of alkynes: Acidity, electrophilic and nucleophilic additions. Hydration to form carbonyl compounds, alkylation of terminal alkynes.</p>	
<b>4</b>	<p><b>Cycloalkanes and Conformational Analysis</b></p> <p>Types of cycloalkanes and their relative stability, Baeyer strain theory, conformation analysis of alkanes. Relative stability, energy diagrams of cyclohexane: chair, boat and twist boat forms. Relative stability with energy diagrams.</p>	<b>8</b>
<b>5</b>	<p><b>Aromatic Hydrocarbons</b></p> <p>Aromaticity: Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Directing effects of the groups</p>	<b>8</b>

#### Course Outcomes (COs):

**CO1:** Demonstrate important terminology in Organic Chemistry, synthesis, structure of Organic compounds, their classification, nomenclature, hybridization, stereo chemistry, and conformation of aliphatic and aromatic hydrocarbons

**CO2:** Construct Fisher projection, Newmann, Sawhorse formulas and their interconversion. Access Geometrical isomerism, Cis-trans and Syn anti with CIP rules. Interpretation of optical isomerism, specific rotation, chirality and enantiomers with D/L and R/S designations.

**CO3:** Compose chemistry of alkanes, alkenes, alkynes with the help of Wurtz, wurtz-fittig and different addition, elimination, substitution reactions.

**CO4:** Predict types of cycloalkanes, their relative stability and Baeyer strain theory. Create energy diagram of cyclohexane, chair, boat and twist forms with their relative stability.

**CO5:** To gain the knowledge about aromaticity, cyclic carbocations, some electrophilic aromatic substitution reactions of benzene and effect of groups.

#### Suggested Readings:

1. Morrison, R. N. & Boyd, R. N; Organic Chemistry, Pearson Education.
2. Finar, I. L. Organic Chemistry: Stereochemistry and the Chemistry of Natural Products (Pearson Education).

3. Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds; Wiley Publication.
4. Kalsi, P. S. Stereochemistry Conformation and Mechanism; New Age International.

**Assessment method:** (Continuous Internal Assessment = 50%, Final Examination = 50%)

## **Basics of Organic Chemistry Lab (B100724252P)**

<b>School Name- School of Sciences</b>			
<b>Program- B.Sc (H) (PCM)</b>			<b>Semester- 2nd</b>
<b>Course Name- Basics of Organic Chemistry Lab</b>			
<b>A.Y- 2025-26</b>	<b>Course Code- B100724252</b>	<b>Batch- 2025-29</b>	<b>CIE Marks- 60 MM</b>
<b>Total Teaching Hours - 30</b>	<b>Total Credits- 0-0-1</b>		<b>ESE Marks- 40 MM</b>
<b>Type of Course- Practical</b>			<b>Total Marks- 100 MM</b>
<b>Course Objective:</b>			
To provide hands-on experience with fundamental laboratory techniques in organic chemistry, enhancing students' understanding of synthesis, purification, and analysis of organic compounds through practical experiments and reinforcing theoretical concepts.			
<b>Course Description:</b>			
This laboratory course introduces essential experimental techniques in organic chemistry, including distillation, recrystallization, chromatography, and spectroscopy. Students will develop skills in safe laboratory practices, data analysis, and report writing while exploring the behavior and properties of organic substances.			

**Practicals:-**

1. To test for Aromaticity of an organic compound.
2. To identify the Functional group from the given organic compounds.
3. To prepare the Lassaigne extract for extra element (N, S, Cl etc) detection.
4. To identify the given organic compound.
5. To identify the given organic compound by using Lassaigne extract.
6. To crystallize the organic compounds by using the following solvent- Water.  
Alcohol, Alcohol-Water
7. To determine the melting points of above compounds and unknown organic compounds (electrically heated melting point apparatus)
8. To determine the effect of impurities on the melting point -mixed melting point of two unknown organic compounds
9. To separate the mixture of two amino acids by ascending and horizontal paper chromatography
10. To separate the mixture of compounds by thin layer chromatography (TLC).

## Differential Equations (B100724203)

School Name- School of Sciences			
Program-B.Sc (H) PCM			Semester- 2nd
Course Name- Differential Equations			
A.Y- 2025-2026	Course Code- B100724203	Batch- 2025-29	CIE Marks- 50 MM
Total Teaching Hours- 45	Total Credits- 3-1-0		ESE Marks- 50 MM
Type of Course- Theory			Total Marks- 100 MM

**Course Objectives: -**

1. To provide hands-on experience with cybersecurity tools and techniques.
2. To understand the practical aspects of securing computer networks, systems, and data.
3. To simulate and analyze security threats and vulnerabilities in real-world scenarios.

<b>UNIT</b>	<b>Topics</b>	<b>No. of Teaching hours/ (Lecture)</b>
<b>1</b>	<b>First Order Differential Equations</b> Degree and Order of a differential equations, Equations of first order and first degree, Equations in which variables are separable, Homogeneous equations and equations reducible to homogeneous form, Linear equations and equations reducible to linear form, Exact differentiable equations and equations which can be made exact, First order but higher degree differential equations solvable for x, y and p, Clairaut's form.	<b>12</b>
<b>2</b>	<b>Second Order differential Equations with Constant Coefficient</b> Introduction, Complementary Function, Methods for finding complementary functions, Particular Integral, Rules to find particular integral, General method of finding the particular integral of any function, Solution of equations, Linear Independence of solution, Wronskian.	<b>11</b>
<b>3</b>	<b>Second order differential Equations with Variable Coefficient</b> Cauchy Euler homogeneous linear differential equations, Legendre's homogeneous equations, Method of reduction, Normal Form, Changing the Independent variable, Method of Variation of Parameters	<b>7</b>
<b>4</b>	<b>Simultaneous equations and Total differentiation</b> Introduction and Solution of Simultaneous equations and Simple problems on Total Differential equation	<b>5</b>
<b>5</b>	<b>Partial Differential Equations</b> Partial differential equations of the first order, Lagrange's linear equation, general method of solution, Homogeneous and non-homogeneous linear partial differential equations with constant coefficient, Equations reducible to equation with constant coefficient.	<b>10</b>

**Course Objectives: -**

1. Students will learn to solve the linear ordinary differential equation of first order and learn the standard methods of solving the DE of first order and first degree.
2. Students will learn to solve the second order DE with constant coefficient and know the

different methods of finding CF and PI.

3. Students will learn to solve the second order DE with variable coefficient by different methods like Cauchy Euler homogeneous linear DE, Legendre's homogeneous equation etc.
4. Students will gain knowledge about simultaneous equation and total differentiation.
5. Students will learn about some special functions (Legendre polynomial and Bessel functions) and their properties

**Text Books:**

1. R.K. Jain and S R K Iyengar, Advance Engineering Mathematics, Narosa publication
2. M.D Raisinghania, Ordinary and Partial Differential Equations, S. Chand Publication

**Reference Books:**

1. Gorakh Prasad, Integral Calculus, Pothishala Private Ltd. Allahabad.
2. S. Balachandra Rao & H.R. Anuradha, Differential Equations with Applications and Programmes, University Press, Hyderabad
3. R.S. Senger, Ordinary Differential Equations with Integration, Prayal Publ.
4. D.A. Murray, Introductory Course in Differential Equations, Orient Longman (India),
5. E.A. Codington, An Introduction to Ordinary Differential Equations, Prentice Hall of India
6. B.Rai, D.P.Choudhary, Ordinary Differential Equations, Narosa Publ.

**Assessment method:** (Continuous Internal Assessment = 50%, Final Examination = 50%)

**3<sup>RD</sup> SEMESTER****Elements of Modern Physics (B100724301)**

<b>School Name- School of Science</b>			
<b>Program- B.Sc (H) PCM</b>			<b>Semester- 3rd</b>
<b>Course Name- Elements of Modern Physics</b>			
<b>A.Y 2025-26</b>	<b>Course Code- B100724301</b>	<b>Batch- 2024-28</b>	<b>CIE Marks- 50 MM</b>
<b>Total Teaching Hours 45</b>	<b>Total Credits- 3-0-0</b>		<b>ESE Marks- 50 MM</b>
<b>Type of Course- Theory</b>			<b>Total Marks 100 MM</b>
<b>Course Objectives</b>			
The objective of this course is to teach the physical and mathematical foundations necessary for learning various topics in modern physics which are crucial for understanding atoms, molecules, photons, nuclei and elementary particles.			
<b>Course Description</b>			
This course provides an in-depth introduction to the foundational concepts and revolutionary discoveries that form the basis of modern physics. It explores the limitations of classical physics and the development of new theories that describe phenomena such as the photoelectric effect, Compton scattering, atomic models, and wave-particle duality. The course also covers applications of quantum theory to atomic, nuclear, and particle physics.			
<b>UNIT</b>	<b>Topics</b>		<b>No. of Teaching hours/ (Lecture)</b>
<b>1</b>	<b>Quantum Mechanics and its Applications</b>  Limitations of classical physics, Heisenberg uncertainty principle (derivation and applications), Wave-particle duality and de Broglie hypothesis, Davisson-Germer experiment for experimental verification of matter waves, Schrödinger wave equation (time-independent and time dependent), Compton effect and its quantum explanation, Particle in a one-dimensional box, Group and phase velocity, Quantum tunnelling (qualitative), Planck's black body radiation law, Pair production and annihilation		<b>10</b>
<b>2</b>	<b>Atomic Models</b>		<b>9</b>

	Rutherford's atomic model and its limitations, Bohr's model and its applications to hydrogen atom, Review of Bohr's model and Sommerfeld's relativistic extension, Vector atom model: quantum numbers, Pauli's exclusion principle, Fine structure, Zeeman and Stark effect (qualitative and semi-quantitative), Quantization of angular momentum, Quantum mechanical model of hydrogen atom: radial and angular wavefunctions, Orbital angular momentum, spin angular momentum, LS and JJ coupling, Selection rules and transition probabilities	
3	<b>Nuclear Physics</b>  Composition and properties of the nucleus, Nuclear binding energy and semi-empirical mass formula (Weizsäcker formula), mass defect, nuclear stability, Radioactivity: types of decay (alpha, beta, gamma), Law of radioactive decay and half-life, Nuclear reactions, Q-value, Fission and fusion processes, Nuclear reactors (basic principles), Nuclear composition: proton-neutron hypothesis, Nuclear forces: properties and meson exchange theory,	9
4	<b>Introduction to Particle Physics</b>  Historical development: discovery of (i) electron (ii) proton (iii) neutron (iv) positron and neutrino, Cosmic rays and early particle detection, Fundamental forces: gravitational, electromagnetic, weak, and strong, Overview of particle accelerators and detectors, Basic concepts of particle physics: Classification of particles: leptons, hadrons, mesons, baryons, conservation laws, quarks and leptons, standard model (brief introduction)	9
5	<b>Special Theory of Relativity</b>  Frames of reference: inertial and non-inertial, Galilean transformations, Michelson-Morley experiment and its implications, Postulates of special relativity, Lorentz transformations, Relativistic momentum and energy, Four-vectors and invariant quantities, Relativistic Doppler effect, Transformation of velocity, Time dilation, length contraction and twin paradox, Mass-energy equivalence and applications in nuclear reactions	8

**Course Outcomes**

**CO1:** Students will be able to understand the failure of classical physics and the foundational principles of quantum mechanics and their application.

**CO2:** students will be able to describe the historical development of atomic models.

**CO3:** students will gain knowledge about the composition and stability of nucleus.

**CO4:** students will be able to gain knowledge about the discovery and classification of particles

**CO5:** students will be able to understand and analyse the special theory of relativity and Einstein's theory.

**Text books:**

1. Modern physics by B.S. Agarwal, S.K. Gupta, Richa Gupta, Kedarnath Ramnath Publication
2. Perspectives of Modern Physics, Latest Edition Dr.Lalit Kumar and Dr.Jyoti Chaudhary
3. Modern Physics (latest edition) by SP Khare, Rastogi Publication

**Reference books:**

1. Elements of Modern Physics by R Murugesan and Kiruthiga Sivaprasath, S. Chand Publishing House
2. Concepts of Modern Physics by Arthur Beiser, Shobhit Mahajan and S Rai Choudhury- 8th/Ed. – 2024, Medtech Science Press

**Assessment method:** (Continuous Internal Assessment = 50%, Final Examination = 50%)

## **Elements of Modern Physics Lab (B1000724351P)**

<b>School Name- School of Science</b>				
<b>Program- B.Sc (H) PCM</b>			<b>Semester- 3rd</b>	
<b>Course Name- Elements of Modern Physics Lab</b>				
<b>A.Y 2026-27</b>	<b>Course Code- B100724351P</b>	<b>Batch- 2025-29</b>	<b>CIE Marks- 60 MM</b>	
<b>Total Teaching Hours - 30</b>	<b>Total Credits- 0-0-1</b>		<b>ESE Marks- 40 MM</b>	
<b>Type of Course- Practical</b>			<b>Total Marks- 100 MM</b>	
<b>Course Objectives/Course Description</b>				
To learn and practice the basic concept of modern physics practically				
	<b>List of Experiments</b>			
	<ol style="list-style-type: none"><li>1. To determine value of Boltzmann constant using V-I characteristic of PN diode.</li><li>2. To determine work function of material of filament of directly heated vacuum diode</li><li>3. To determine value of Planck's constant using LEDs of at least 4 different colours.</li></ol>			

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|---|--|
| <ol style="list-style-type: none"> <li>4. To determine the ionization potential of mercury.</li> <li>5. To determine the wavelength of H-alpha emission line of Hydrogen atom.</li> <li>6. To determine the absorption lines in the rotational spectrum of Iodine vapour.</li> <li>7. To study the diffraction patterns of single and double slits using laser source and measure its intensity variation using Photosensor and compare with incoherent source – Na light.</li> <li>8. Photo-electric effect: photo current versus intensity and wavelength of light; maximum energy of photo-electrons versus frequency of light.</li> <li>9. To determine the value of e/m by magnetic focusing.</li> </ol> |  |
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**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, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. A Text Book of Practical Physics, Indu Prakash and Ramakrishna, 11th Edition, 2011, Kitab Mahal, New Delhi.

## Chemistry of s & p Block Elements (B100724302)

<b>School Name- School of Sciences</b>			
<b>Program- B.Sc (H) PCM</b>			<b>Semester- 3rd</b>
<b>Course Name- Chemistry of s &amp; p Block Elements</b>			
<b>A.Y- 2025-26</b>	<b>Course Code- B100724302</b>	<b>Batch- 2024-28</b>	<b>CIE Marks- 50 MM</b>
<b>Total Teaching Hours - 45</b>	<b>Total Credits- 3-0-0</b>		<b>ESE Marks- 50 MM</b>
<b>Type of Course- Theory</b>			<b>Total Marks- 100 MM</b>

**Course Objectives/Course Description**

The main objective is to introduce the undergraduates about the basic concepts of metallurgy, acid base concepts, s and p block elements and noble gases.

- To introduce general principles of metallurgy
- To apply concepts of acids and bases
- To study chemistry of s and p block elements, noble gases and inorganic polymers

Upon successful completion students should be able to:

- Gain an idea about general principles of metallurgy, acid-base concepts.
- Gain a thorough knowledge about the s and p Block Elements
- Able to predict structure of noble gas compounds and their reactivity
- Will gain a firm idea about silicones and siloxanes. Borazines, silicates and phosphazenes.

UNIT	Topics	No. of teaching hours/ lecture)
1	<b>General Principals of metallurgy</b> Chief modes of occurrence of metals based on standard electrode potentials, Ellingham diagrams for reduction of metal oxides using carbon monoxide as reducing agent. Electrolytic reduction, Hydrometallurgy with reference to cyanide process for Ag and Au.	09
2	<b>Methods of purification of metals</b> Electrolytic process, Van Arkel –De Boer process, Zone refining. Brief discussion of metals and alloys used in ancient and medieval india.	09
3	<b>Chemistry of s-Block Elements</b> General characteristics: melting point, flame colouration, reducing nature, diagonal relationships and anomalous behaviour of first member of each group Reactions of alkali and alkaline earth metals with oxygen, hydrogen, nitrogen and water. Common features such as ease formation, thermal stability, energetics of dissolution and solubility of the following alkali and alkaline earth metal compounds: hydrides, oxides, peroxides, superoxide, carbonates & nitrates, sulphates.	10
4	<b>Chemistry of p-block elements</b> Electronic configuration, atomic and ionic size, metallic/non-metallic character, melting point, ionization enthalpy, electron gain enthalpy, Catenation , Allotropy of C,P,S.	08
5	<b>Compounds of p-Block Elements</b> Acidic/Basic nature stability, ionic/covalent nature, oxidation /reduction, hydrolysis, action of heat on the following: <ul style="list-style-type: none"><li>• Hydrides of group 13(only diborane), Group 14, Group 15.</li></ul>	09

- |  |  |  |
|--|--|--|
|  | <ul style="list-style-type: none"><li>• Oxoacids of Phosphorus, sulphur and chlorine</li><li>• Interhalogen and pseudohalogen compound</li></ul> |  |
|--|--|--|

**Course Outcomes**

**CO-1** Understanding the principles of different metallurgical procedures with respect to different metals.

**CO-2** Comparison of different properties of s and p block elements. Intergroup and intragroup comparison.

**CO-3** Comparative study of listed compounds of s and p block elements.

**CO-4** Detailed study of specific compounds of p block elements mentioned in the syllabus w.r.t. their synthesis, structure, properties, bonding and uses

**Text books:**

1. Concise Inorganic Chemistry, Fifth Edition; J.D. Lee; Wiley India(P) Ltd, New Delhi, 2008.
2. Principles of Inorganic Chemistry, Thirty Third Edition; B.R. Puri, L.R. Sharma, K.C. Kalia; Vishal Publishing Co., Delhi, 2020.

**Reference Books**

1. Inorganic Chemistry, Seventh International Edition; M. Weller, T. Overton, J. Rourke, F. Armstrong; Oxford University Press, New York, 2018.
2. Inorganic Chemistry, Fifth Edition; G. L. Miessler and D. A. Tarr; Pearson Education Inc. Singapore, 2013.

**e-Resources:**

1. <https://egyankosh.ac.in/bitstream/123456789/15633/1/Unit-15.pdf> (Unit I)
2. <https://egyankosh.ac.in/bitstream/123456789/15700/1/Unit-5.pdf> (Unit II)
3. [https://chem.libretexts.org/Bookshelves/Inorganic\\_Chemistry/Chemistry\\_of\\_the\\_Main\\_Group\\_Elements\\_\(Barron\)](https://chem.libretexts.org/Bookshelves/Inorganic_Chemistry/Chemistry_of_the_Main_Group_Elements_(Barron)) (Unit III and IV)
4. [https://saylordotorg.github.io/text\\_general-chemistry-principles-patterns-and-applications-v1.0/s26-the-p-block-elements.html](https://saylordotorg.github.io/text_general-chemistry-principles-patterns-and-applications-v1.0/s26-the-p-block-elements.html) (Unit III and IV)
5. <https://egyankosh.ac.in/handle/123456789/5241> (Unit III and IV)

**Assessment method:** (Continuous Internal Assessment = 50%, Final Examination = 50%)

## Chemistry of s & p Block Elements Lab (B100724352P)

<b>School Name- School of Sciences</b>			
<b>Program- B.Sc (H) PCM</b>			<b>Semester- 3rd</b>
<b>Course Name- Chemistry of s &amp; p Block Elements Lab</b>			
<b>A.Y- 2025-26</b>	<b>Course Code- B100724352P</b>	<b>Batch- 2024-28</b>	<b>CIE Marks- 60 MM</b>
<b>Total Teaching Hours - 30</b>	<b>Total Credits- 0-0-1</b>		<b>ESE Marks- 40 MM</b>
<b>Type of Course- Practical</b>			<b>Total Marks- 100 MM</b>
<b>Course Objectives/Course Description</b>			
<p>Students will learn to synthesize and characterize compounds of s and d block elements, including complexes, salts, and other inorganic compounds. Experiments may involve titrations, spectrophotometry, and other analytical techniques to determine the composition and concentration of these compounds. students will learn to identify and distinguish between different s and d block elements through qualitative tests. Through experiments, students will observe and understand the reactivity and bonding characteristics of s and d block elements, including their tendency to form complexes, oxidation states, and reaction types.</p>			

## List of Experiments

### A.Redox titrations:-

- (i) Estimation of Fe(II) with  $K_2Cr_2O_7$  using diphenyl amine as indicator.
- (ii) Estimation of Fe(II) with  $K_2Cr_2O_7$  using N-phenyl anthranilic acid as internal indicator .
- (iii) Estimation of Fe(II) with  $K_2Cr_2O_7$  using external indicator.

### B. Iodo / Iodometric Titrations:-

- (iv) Estimation of Cu (II) using sodium thiosulphate solution (Iodometrically)
- (v) Estimation of  $K_2Cr_2O_7$  using sodium thiosulphate (Iodometrically)
- (vi) Estimation of antimony in tartaric acid iodometrically.
- (vii) Estimation of Iodine content in Iodized salt.

Essential / recommended reading-for Practicals-

1. Jeffery, G.H;Bassett, J;Mendham, J;Denney, R.C.(1989), Vogel's Text book of Quantitative Chemical Analysis, John Wiley and Sons.
2. Day R.A; Unerwood ,A.L.(2012), Quantitative Analysis ,6<sup>th</sup> Edition, PHI Learning Private Limited.

## Real Analysis (B100724303)

School Name- School of Sciences

Program- B.Sc. (H) PCM

Semester-3rd

Course Name- Real Analysis

A.Y.: 2025-2026

Course Code-  
B100724303

Batch-  
2024-28

CIE Marks- 50 MM

Total Teaching Hours: 45

Total Credits- 3-1-0

ESE Marks- 50 MM

Type of Course- Theory

Total Marks- 100 MM

**Course Objectives: -**

The objective of this course is to provide students with knowledge of

1. The real line with algebraic, order and completeness property
2. Convergence and divergence of sequences and series of real numbers with applications.
3. Monotonicity of sequences and Cauchy criterion.
4. Continuous nature of real functions.
5. Infinite series and its convergence.

**Course Description: -**

The course revolves around the idea of concept of real numbers and its applications in real life involving the study of sequences and subsequences with Cauchy criterion of limit and boundedness explaining Bolzano. Weierstrass Theorem. The course also provides the knowledge of continuity of functions in terms of sequences and gives the understanding of infinite series including its convergence and divergence.

<b>UNIT</b>	<b>Topics</b>	<b>No. of Teaching hours/ (Lecture)</b>
<b>1</b>	<b>Real Numbers</b> Basic Properties of the Set of Real Numbers Field and order properties of $\mathbb{R}$ , basic properties and inequalities of the absolute value of a real number, bounded above and bounded below sets, Suprema and infima, The completeness axiom and the Archimedean property of $\mathbb{R}$ .	<b>10</b>
<b>2</b>	<b>Sequences in Real</b> Real Sequences Convergence, subsequences, Algebra of limits, The squeeze principle and applications, Bolzano-Weierstrass Theorem.	<b>8</b>
<b>3</b>	<b>Monotonicity and Sequences</b> Monotone sequences, Monotone convergence theorem and applications, Cauchy sequences, Cauchy criterion for convergence and applications.	<b>9</b>
<b>4</b>	<b>Continuity</b> Continuous Functions, Properties of Continuous Functions, Uniform Continuity, Non-Uniform continuity.	<b>8</b>
<b>5</b>	<b>Infinite Series</b> Infinite Series, Convergence and divergence of infinite series of real	<b>10</b>

numbers, Necessary condition for convergence, Cauchy criterion for convergence of series, Tests for convergence of positive term series, Applications of the integral test, Comparison tests, D'Alembert's ratio test, Cauchy's nth root test; Alternating series, Leibniz alternating series test.	
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**Course Outcomes: -**

This course will enable the students to:

**CO 1** Understand the basic properties of the set of real numbers, including completeness and Archimedean with some consequences.

**CO 2** Study the meaning of sequences and its limit involving Bolzano-Weierstrass Theorem.

**CO 3** Learn the monotonic nature of sequence including Cauchy Criterion for convergence.

**CO 4** Know the concept of continuity and uniform continuity in terms of sequential limits.

**CO 5** Recognize Infinite series and learn to apply various tests such as limit comparison, ratio, root, integral and Leibnitz test on Infinite Series.

**Text books:**

1. Bartle, Robert G., & Sherbert, Donald R. (2011). Introduction to Real Analysis (4th ed.). John Wiley & Sons. Wiley India Edition 2015.
2. Bilodeau, Gerald G., Thie, Paul R., & Keough, G. E. (2010). An Introduction to Analysis (2nd ed.). Jones & Bartlett India Pvt. Ltd. Student Edition. Reprinted 2015.
3. S.C Malik and Savita Arora, Mathematical Analysis.
4. Shanti Narayan and M.D. Raisinghania Elements of Real Analysis.

**Reference books:**

1. Denlinger, Charles G. (2011). Elements of Real Analysis. Jones & Bartlett India Pvt. Ltd. Student Edition. Reprinted 2015.
2. Shanti Narayan and Mittal, Mathematical Analysis.
3. S.K.Mapa, Introduction to Real Analysis.

**Assessment method:** (Continuous Internal Assessment = 50%, Final Examination = 50%)

**4<sup>TH</sup> SEMESTER****Solid State Physics (B100724401)**

<b>School Name- School of Science</b>			
<b>Program- B.Sc (H) PCM</b>			<b>Semester- 4th</b>
<b>Course Name- Solid State Physics</b>			
<b>A.Y 2025-26</b>	<b>Course Code- B100724401</b>	<b>Batch- 2024-28</b>	<b>CIE Marks- 50 MM</b>
<b>Total Teaching Hours 45</b>	<b>Total Credits- 3-0-0</b>		<b>ESE Marks- 50 MM</b>
<b>Type of Course- Theory</b>			<b>Total Marks 100 MM</b>
<b>Course Objectives</b>			
<p>This course provides a comprehensive introduction to the fundamental concepts and principles of Solid State physics. Students will develop an understanding of the microscopic origin of material properties and their implications in the design and development of advanced materials for technological applications.</p>			
<b>Course Description</b>			
<p>This course includes theoretical description of crystal and electronic structure, lattice dynamics, and optical properties of different materials (metals, semiconductors, dielectrics, magnetic materials and superconductors), based on the classical and quantum physics principles</p>			
<b>UNIT</b>	<b>Topics</b>		<b>No. of Teaching hours/ (Lecture)</b>
<b>1</b>	<b>CRYSTAL STRUCTURE</b> 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, Miller indices, lattice planes, spacing of planes in crystal lattices, basic idea about liquid crystal, X ray diffraction, Bragg equations, Determination of crystal structure with X-rays, Laue and Powder method, Reciprocal lattice system, Ewald's construction		<b>12</b>
<b>2</b>	<b>BAND THEORY OF SOLIDS</b> Free electron theory of metals, electrical conductivity, thermal conductivity, Wiedemann-Franz law, Band formation in solids, Band structure in conductors, Periodic potential and Bloch theorem, Kronig-Penny model, origin of band gap, Semiconductors, effect of		<b>10</b>

	impurity on semiconductor, Fermi level, Electron and hole concentration, drift current, mobility and conductivity, Effective mass, Hall effect.	
<b>3</b>	<b>SPECIFIC HEAT AND DIELECTRIC PROPERTIES OF MATERIALS</b>  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 thermal conductivity, Dielectric properties: Electronic, ionic and dipolar polarizability, local fields, induced and oriented polarization, molecular field in a dielectric, Clausius-Mossotti relation.	<b>10</b>
<b>4</b>	<b>MAGNETIC PROPERTIES OF MATERIALS</b>  magnetization, Dia, para and ferromagnetic properties of solids, magnetic moment, spin angular moment, Langevin's theory of diamagnetism and paramagnetism, Curie's law, Ferromagnetism, hysteresis and hysteresis loss, permanent magnet, spontaneous magnetization and domain structure, Weiss theory of ferromagnetism, anti- Ferromagnetism, ferrites, use of ferrites.	<b>8</b>
<b>5</b>	<b>SUPERCONDUCTIVITY</b>  Introduction (Kamerlingh-Onnes experiment), effect of magnetic field, Type-I and type-II superconductors, BCS theory, Cooper pair, Isotope effect, Meissner effect, Heat capacity, Energy gap, Basic Ideas about High-Tc superconductors, application.	<b>5</b>

**Course Outcomes:**

**CO1** Students will able to understand and describe the fundamental concepts of crystal structures.

**CO 2** Students will gain knowledge on formation of energy bands in solids and apply it to explain the behaviour of metals and semiconductors.

**CO 3** Students will able to understand the basic concept of specific heat of solids and dielectric properties.

**CO 4** students will gain knowledge about fundamental concepts of magnetism to study the effects of temperature, structure and composition on the magnetic properties of materials.

**CO 5** Students will be able to understand about superconductors for practical applications.

**Text books:**

1. Solid state physics by RK Puri and VK Babbar, S. Chand publishing house
2. Solid State Physics, 10th Edition by SO Pillai, NEW AGE International Publihsers
3. Solid State Physics by RJ Singh, Pearson Education India

**Reference books:**

1. Introduction to solid state physics by Arun Kumar, PHI Learning; Second edition
2. Introduction to Solid State Physics by Charles Kittel, 8<sup>th</sup> edition, Wiley
3. Solid State Physics, N. Ashcroft and D. Mermin, Cengage.
4. Condensed Matter Physics, M. P. Marder, Wiley.

**Assessment method:** (Continuous Internal Assessment = 50%, Final Examination = 50%)

## Solid State Physics Lab (B100724451P)

<b>School Name- School of Science</b>			
<b>Program- B.Sc (H) PCM</b>			<b>Semester- 4th</b>
<b>Course Name- Solid State Physics Lab</b>			
<b>A.Y 2025-26</b>	<b>Course Code- B100724451P</b>	<b>Batch- 2024-28</b>	<b>CIE Marks- 60 MM</b>
<b>Total Teaching Hours - 30</b>	<b>Total Credits- 0-0-1</b>		<b>ESE Marks- 40 MM</b>
<b>Type of Course- Practical</b>			<b>Total Marks- 100 MM</b>
	<b>List of Experiments</b>		
	<ol style="list-style-type: none"> <li>1. Measurement of susceptibility of paramagnetic solution (Quinck`s Tube Method)</li> <li>2. To measure the Magnetic susceptibility of Solids.</li> <li>3. To determine the Coupling Coefficient of a Piezoelectric crystal.</li> <li>4. To measure the Dielectric Constant of a dielectric Materials with frequency</li> <li>5. To determine the complex dielectric constant and plasma frequency of metal using Surface Plasmon resonance (SPR)</li> </ol>		

	technique. 6. To determine the refractive index of a dielectric layer using SPR technique. 7. To study the PE Hysteresis loop of a Ferroelectric Crystal. 8. To draw the BH curve of iron using a Solenoid and determine the energy loss from Hysteresis. 9. To measure the resistivity of a semiconductor (Ge) crystal with temperature (up to 150° C) by four-probe method and to determine its band gap. 10. To determine the Hall coefficient of a semiconductor sample.	
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**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, 4th Edition, reprinted 1985, Heinemann Educational Publishers
3. Elements of Solid State Physics, J.P. Srivastava, 2nd Ed., 2006, Prentice-Hall of India

## Solutions, Conductance and Electrochemistry (B100724402)

<b>School Name- School of Sciences</b>			
<b>Program-B.Sc (H) PCM</b>			<b>Semester- 4th</b>
<b>Course Name- Solutions, Conductance and Electrochemistry</b>			
<b>A.Y- 2025-2026</b>	<b>Course Code- B100724402</b>	<b>Batch- 2024-28</b>	<b>CIE Marks- 50 MM</b>
<b>Total Teaching Hours- 45</b>	<b>Total Credits- 3-0-0</b>		<b>ESE Marks- 50 MM</b>
<b>Type of Course- Theory</b>			<b>Total Marks- 100 MM</b>
<b>Course Objectives/Course Description-</b>			
<p>From this course the student will learn about laws in electrochemistry and electrical properties like solubility product and common ion effect and conductance etc. and apply them in experiments. Learn about strong acids and bases and weak acid and bases and derivation of hydrolysis constant for their salts, electrochemical cells, types of electrodes and to determine their EMF. Be able to examine different types of phase diagrams of one component and two component systems and types of types of</p>			

liquid liquid mixtures.

UNIT	Topics	No. of Teaching hours/ (Lecture)
1	<b>Solutions</b> Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions. Vapour pressure-composition and temperature-composition curves of ideal and nonideal solutions. Distillation of solutions. Lever rule. Azeotropes.	10
2	<b>Partial miscibility of liquids</b> Critical solution temperature; effect of impurity on partial miscibility of liquids. Immiscibility of liquids- Principle of steam distillation. Nernst distribution law and its applications, solvent extraction.	8
3	<b>Conductance</b> Conductivity, equivalent and molar conductivity and their variation with dilution for weak and strong electrolytes. Kohlrausch law of independent migration of ions. Transference number and its experimental determination using Hittorf and Moving boundary methods. Ionic mobility. Applications of conductance measurements: determination of degree of ionization of weak electrolyte	9
4	<b>Solubility</b> Solubility and solubility products of sparingly soluble salts, ionic product of water, hydrolysis constant of a salt. Conductometric titrations (only acid-base).	8
5	<b>Electrochemistry</b> Reversible and irreversible cells. Concept of EMF of a cell. Measurement of EMF of a cell. Nernst equation and its importance. Types of electrodes. Standard electrode potential. Electrochemical series. Thermodynamics of a reversible cell, calculation of thermodynamic properties: G, H and S from EMF data. Calculation of equilibrium constant from EMF data. Concentration cells with transference and without transference. Liquid junction potential and salt bridge. Catalyst and catalysis. pH determination using hydrogen electrode and quinhydrone	10

electrode.	
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**Course Outcomes:**

**CO-1** To explain the conductance and its variation with dilution, molar and equivalent conductance

**CO-2** To explain migration of ions under the influence of external potential

**CO-3** To explain and derive the mathematical expressions of different rate laws

**CO-4** Learn the basics and theories of rate of reaction and enzyme catalyzed reactions

**CO-5** Have an understanding of laws of absorption of light energy and reactions catalyzed by light  
i.e. photochemical reactions

**Text Books:**

1. Atkins P. W. & Paula, J. de, Elements of Physical Chemistry, Oxford University Press, 6 th Ed., (2006).
2. Puri, Sharma & Pathania, Principles of Physical Chemistry, Vishal Publishing Co, 47th Edn., 2017.
3. Kapoor, K. L., Text Book of Physical Chemistry, Mac Grow Hill, 3rd Edn., 2017
4. Castellan G. W. Physical Chemistry 4th Ed. Narosa (2004).

**Reference Books:**

1. Engel T. & Reid P., Physical Chemistry 3rd Ed. Pearson (2013).
2. Levine, I. N. Physical Chemistry 6th Ed., Tata McGraw-Hill (2011).
3. McQuarrie, D. A. & Simon, J. D. Molecular Thermodynamics Viva Books Pvt. Ltd.: New Delhi (2004).
4. Kheterpal S.C., Pradeep's Physical Chemistry, Vol. I & II, Pradeep Publications

**Assessment method:** (Continuous Internal Assessment = 50%, Final Examination = 50%)

## Solutions, Conductance and Electrochemistry Lab (B100724452)

<b>School Name- School of Sciences</b>			
<b>Program-B.Sc (H) PCM</b>			<b>Semester- 4th</b>
<b>Course Name- Solutions, Conductance and Electrochemistry Lab</b>			
<b>A.Y- 2025-26</b>	<b>Course Code- B100724452</b>	<b>Batch-2024- 28</b>	<b>CIE Marks- 60 MM</b>
<b>Total Teaching Hours- 30</b>	<b>Total Credits- 0-0-1</b>		<b>ESE Marks- 40 MM</b>
<b>Type of Course- Practical</b>			<b>Total Marks- 100 MM</b>
<b>Course Objectives/Course Description-</b>			
<p>From this course the student will learn about laws in electrochemistry and electrical properties like solubility product and common ion effect and conductances etc. and apply them in experiments. Learn about strong acids and bases and weak acid and bases and derivation of hydrolysis constant for their salts, electrochemical cells, types of electrodes and to determine their EMF.</p>			
<b>Practicals- Electrochemistry Lab</b>			
<b>Conductometry</b>			
<ol style="list-style-type: none"><li>1. Determination of cell constant.</li><li>2. Determination of equivalent conductance, degree of dissociation and dissociation constant of a weak acid.</li><li>3. Perform the following conductometric titrations:<ol style="list-style-type: none"><li>i. Strong acid vs. strong base</li><li>ii. Weak acid vs. strong base</li><li>iii. Strong acid vs. weak base</li></ol></li></ol>			
<b>Potentiometry</b>			
Perform the following potentiometric titrations:			
<ol style="list-style-type: none"><li>i. Strong acid vs. strong base</li><li>ii. Weak acid vs. strong base</li><li>iii. Dibasic acid vs. strong base</li></ol>			
<b>Suggested Reading-</b>			
<ol style="list-style-type: none"><li>1. Khosla, B. D.; Garg, V. C. &amp; Gulati, A., Senior Practical Physical Chemistry, R. Chand &amp; Co., New Delhi (2011).</li><li>2. Garland, C. W.; Nibler, J. W. &amp; Shoemaker, D. P., Experiments in Physical Chemistry 8th Ed.; McGraw-Hill: New York (2003).</li><li>3. Halpern, A. M. &amp; McBane, G. C., Experimental Physical Chemistry 3rd Ed.; W.H. Freeman &amp; Co., New York (2003).</li></ol>			

## Linear Algebra (B100724403)

<b>School Name- School of Sciences</b>			
<b>Program- B.Sc (H) PCM</b>			<b>Semester- 4th</b>
<b>Course Name- Linear Algebra</b>			
<b>A.Y.: 2025-2026</b>	<b>Course Code- B100724403</b>	<b>Batch- 2024-28</b>	<b>CIE Marks- 50 MM</b>
<b>Total Teaching Hours: 45</b>	<b>Total Credits- 3-1-0</b>		<b>ESE Marks- 50 MM</b>
<b>Type of Course- Theory</b>			<b>Total Marks- 100 MM</b>

**Course Objectives:** -The objective of this course is to introduce:

1. The concept of matrices and its applications including vectors and their linear independence and dependence.
2. The idea of eigenvalues and eigenvectors along with Cayley Hamilton Theorem.
3. Vector Spaces and subspaces involving basis and dimension.
4. Rank and nullity of linear transformations through matrices.
5. Various applications of vectors in computer graphics and movements in planes.

**Course Description: -**

The course initiates the idea of matrices and its application introducing the concept of vectors and their linear dependency and independency. The course also includes the study of eigenvalues and eigenvectors making base for Cayley Hamilton Theorem. Then the concept of Vector spaces and subspaces is introduced, further it provides the study of linear transformation and its applications.

UNIT	Topics	No. of Teaching
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		<b>hours/ (Lecture)</b>
<b>1</b>	<b>Vectors and Matrices</b> Matrices, Properties of matrices, Fundamental operations with vectors in Euclidean space, Linear combinations of vectors, solving linear systems using Gaussian elimination, Gauss-Jordan row reduction, Reduced row echelon form, Equivalent systems, Rank and row space.	<b>10</b>
<b>2</b>	<b>Eigenvalues and Eigenvectors</b> Eigenvalues, Eigenvectors, Eigenspace, Diagonalization, Characteristic polynomial of a matrix, Cayley-Hamilton theorem.	<b>8</b>
<b>3</b>	<b>Vector Spaces</b> Vector spaces, Subspaces, Algebra of subspaces, Linear combination of vectors, Linear span, Linear independence, Bases and dimension, Dimension of subspaces.	<b>10</b>
<b>4</b>	<b>Linear Transformations</b> Linear transformations, Null space, Range, Rank and nullity of a linear transformation, Matrix representation of a linear transformation, Algebra of linear transformations.	<b>9</b>
<b>5</b>	<b>Isomorphisms</b> Invertibility and isomorphisms; Application: Computer Graphics-Fundamental movements in a plane, homogeneous coordinates, composition of movements.	<b>8</b>

**Course Outcomes: -This course will enable the students to:**

1. Visualize the space in terms of vectors and their interrelation with matrices.
2. Understand the meaning of eigenvalues and eigenvectors with Cayley Hamilton Theorem.
3. Familiarize with basic concepts in vector spaces, linear independence and span of vectors over a field.
4. Learn about the concept of linear transformation along with the basis and dimension of a vector space.
5. Know the basics of isomorphism, matrix representation of a linear transformation with

application to computer graphics.

**Text books:**

1. Andrilli, S., & Hecker, D. (2016). Elementary Linear Algebra (5th ed.).
2. Friedberg, Stephen H., Insel, Arnold J., & Spence, Lawrence E. (2003). Linear Algebra
3. Lay, David C., Lay, Steven R., & McDonald, Judi J. (2016). Linear Algebra and its Applications (5th ed.)

**Reference books:**

1. Kolman, Bernard, & Hill, David R. (2001). Introductory Linear Algebra with Applications (7th ed.).
2. Hoffman, Kenneth, & Kunze, Ray Alden (1978). Linear Algebra (2nd ed.).

**Assessment method:** (Continuous Internal Assessment = 50%, Final Examination = 50%)

## Linear Algebra Lab (B100724453P)

School Name- School of Sciences

Program- B.Sc. (H) PCM

Semester-4th

Course Name- Linear Algebra Lab

A.Y.: 2025-2026

Course Code-  
B100724453P

Batch-  
2024-28

CIE Marks- 60 MM

<b>Total Teaching Hours: 30</b>	<b>Total Credits- 0-0-1</b>	<b>ESE Marks- 40 MM</b>
<b>Type of Course- Practical</b>		<b>Total Marks- 100 MM</b>

**Course Objectives: -**

1. Knowledge of representation of matrices and vectors.
2. Learning of performing operations on matrices.
3. Find the determinant, trace inverse and transpose of a matrix.
4. Evaluation of a matrix in the reduced row Echelon Form.
5. To calculate the solution to a system of linear equations.
6. To provide practical knowledge of eigenvalues and eigenvectors in order to prove Cayley Hamilton Theorem.

**Course Description: -**

This course provides the students with practical knowledge of matrices and vectors and the basic operations applied on them. It also involves the applications to eigenvalues and eigenvectors which helps in understanding Cayley Hamilton Theorem. The course includes the practicals of linear transformations that develops students in depth knowledge for homomorphism and isomorphism.

<b>S. No.</b>	<b>Practicals</b>	
1.	Matrix and Vector Representation	
2.	Operations on Matrices	
3.	Determinants and Traces	
4.	Inverse and Transpose	
5.	Row Reduced Echelon Form	
6.	Linear System of Equations	
7.	Eigenvalues and Eigen Vectors	
8.	Linear transformations	

## GROUP THEORY - I (B100724404)

<b>School Name- School of Sciences</b>			
<b>Program- B.Sc. (H) PCM</b>			<b>Semester-4th</b>
<b>Course Name- Group Theory-I</b>			
<b>A.Y.: 2025-2026</b>	<b>Course Code- B100724404</b>	<b>Batch- 2024-28</b>	<b>CIE Marks- 50 MM</b>
<b>Total Teaching Hours: 45</b>	<b>Total Credits- 3-0-0</b>		<b>ESE Marks- 50 MM</b>
<b>Type of Course- Theory</b>			<b>Total Marks- 100 MM</b>

**Course Objectives: -** The objective of this course is to introduce:

1. Basics of Group and Subgroup.
2. Knowledge of cyclic group and Fundamental Theorem of Cyclic group.
3. Learning of permutation of a set and then of a permutation group itself.
4. Understanding of cosets with applications of Lagrange's Theorem, Fermat's Theorem,
5. Cauchy' Theorem for Abelian Group and that of normal groups and factor groups.

**Course Description: -**

The course provides the basic concept of groups, subgroups, some specific groups such as dihedral group, abelian group, cyclic group, permutation group, finite group, including Fundamental Theorem of Cyclic group, along with their properties and examples. The course also gives the idea of cosets further explaining Lagrange's Theorem, Fermat's Little Theorem. It involves basic knowledge of normal subgroups and factor groups and Cauchy's Theorem for Abelian Group.

<b>UNIT</b>	<b>Topics</b>	<b>No. of Teaching hours/ (Lecture)</b>
<b>1</b>	<b>Group</b> Binary Operation, group with examples, dihedral groups, abelian groups, general linear group, special linear group, elementary properties of groups: uniqueness of the identity and inverse, cancellation, socks-shoes property, order of group, order of element, finite group, subgroups, subgroup tests.	<b>10</b>
<b>2</b>	<b>Cyclic Group</b> Centre of a group and its properties, centralizer and its properties, generator, cyclic group with examples, criterion for , orders of elements in finite cyclic groups, generators of finite cyclic groups,	<b>8</b>

	Fundamental theorem of Cyclic groups, Euler phi function, number of elements of each order in a cyclic group.	
<b>3</b>	<b>Permutation &amp; Symmetric Groups</b> Permutation of a set, permutation group, symmetric groups, cyclic notations of permutation groups and their properties, disjoint cycles and its properties, order of permutation, 2-cycles, even and odd permutations.	<b>10</b>
<b>4</b>	<b>Cosets</b> Coset of subset of group, properties of cosets, Lagrange's Theorem and its consequences, converse of Lagrange's Theorem, Fermat's Little Theorem.	<b>9</b>
<b>5</b>	<b>Normal and Factor Subgroup</b> Normal subgroup, Normal subgroup Test, factor group, $G/Z$ Theorem, Cauchy Theorem for Abelian group.	<b>8</b>

**Course Outcomes:** - This course will enable the students to:

1. Understand basic concepts of groups, subgroups and finite group.
2. Learn about cyclic group with understanding of Fundamental Theorem of Cyclic Group.
3. Emphasize the application of permutation groups and alternating groups.
4. Know about cosets and applications of Lagrange's Theorem and Fermat's Little Theorem.
5. Learn the fundamentals of Normal Group and Factor Groups along with Cauchy Theorem for Abelian Group.

**Text books:**

1. Gallian, Joseph. A. (2017). Contemporary Abstract Algebra (9th ed.)
2. Artin, Michael. (1991). Algebra (2nd ed.)
3. Dummit, David S., & Foote, Richard M. (2016). Abstract Algebra (3rd ed.).

**Assessment method:** (Continuous Internal Assessment = 50%, Final Examination = 50%)