UNDERGRADUATE DEGREE COURSE

Bachelor of Science (PCM)

University of Technology

Vatika Road, Jaipur Rajasthan 303903

UNDERGRADUATE DEGREE COURSE Department of B.Sc. (PCM) 2023	
Program Outcomes	
PO 1	Students will be able to demonstrate a fundamental understanding of concepts of subject including Physics, Chemistry & Mathematics
PO 2	Students will be proficient in mathematical and computational skills, enabling them to model physical systems, solve complex problems, and analyze experimental data effectively.
PO 3	Students will be adept in experimental and laboratory skills, mastering experimental design, data collection, instrumentation, and analysis techniques relevant to physics.
PO 4	Students will be able to apply the concept in interdisciplinary contexts, integrating their knowledge into fields such as engineering, materials science, biophysics, and environmental science.
PO 5	Students will be capable of cultivating critical thinking and problem-solving abilities, analyzing theoretical models, interpreting experimental results, and addressing complex problems.
PO 6	Students will acquire advanced knowledge in specialized areas of science
PO 7	Students will be proficient in utilizing quantitative and qualitative analysis skills, investigating physical phenomena, interpreting data, and deriving meaningful conclusions.
PO 8	Students will effectively communicate scientific ideas, presenting concepts, experimental findings, and theoretical models through written reports, oral presentations, and visual representations.
PO 9	Students will uphold ethical and professional conduct in science, demonstrating integrity, responsibility, and collaboration in scientific research and laboratory practices.
PO 10	Students will integrate theoretical concepts with practical applications, applying their knowledge to technological innovations, industrial advancements, and theoretical developments.
PO 11	Students will prepare for advanced studies and research in subject, equipping themselves for careers in academia, research institutions, industry, and governmental agencies.
PO 12	Students will contribute to scientific knowledge and innovation, advancing the field through research, innovation, and the application of science principles to address global challenges.
Program Specific Outcomes	
PSO 1	Demonstrate mastery in applying fundamental principles of subjects Physics, Chemistry & Math

PSO 2	Develop the ability to analyze and predict the behavior of systems, including Physics, Chemistry & Math
PSO 3	Develop the ability to design and conduct experiments to test hypotheses and gather data to support physical principles.
PSO 4	Develop the ability to use computational tools, such as simulations and programming languages, to model and analyze physical systems.
PSO 5	Attainan in-depth knowledge of the principles of modern physics, including relativity, quantum mechanics, and particle physics.
Program Educational Objectives	
PEO 1	To develop a thorough understanding of fundamental concepts of the subjects
PEO 2	To acquire proficiency in experimental techniques, including data collection, analysis using advanced laboratory equipment, and quantitative methods.
PEO 3	To master computational modeling and simulation skills, enabling prediction and analysis of physical phenomena in diverse scientific and technological applications.
PEO 4	To foster critical thinking and problem-solving abilities, facilitating the analysis of theoretical models, interpretation of experimental data, and application of physics principles to real-world challenges.
PEO 5	To enhance communication skills, enabling effective presentation of scientific ideas and collaboration in interdisciplinary teams for advancing knowledge and innovation in physics.

UNDERGRADUATE DEGREE COURSE

B.Sc. (PCM) - 1st Year

JULY-2023

University of Technology

Vatika Road, Jaipur Rajasthan 303903

UNIVERSITY OF TECHNOLOGY, JAIPUR

Teaching & Examination Scheme

B.Sc. (PCM) - 1st Year

Sr. No.	Subject Name	Subject Code	Subject Type	Credit Point	Tot. Max Marks	Int. Min Marks	Int. Max Marks	Ext. Min Marks	Ext. Max Marks	Teach Hours
1	General Hindi	BPCM 101	Theoretical	2	100	0	0	36	100	2
2	General English	BPCM 102	Theoretical	2	100	0	0	36	100	2
3	Environmental Studies	BPCM 103	Theoretical	2	100	0	0	36	100	2
4	Elementary Computer	BPCM 104	Theoretical	1	60	0	0	22	60	1
5	Physics - I	BPCM 105	Theoretical	3	50	0	0	18	50	3
6	Physics - II	BPCM 106	Theoretical	3	50	0	0	18	50	3
7	Physics - III	BPCM 107	Theoretical	3	50	0	0	18	50	3
8	Chemistry - I	BPCM 108	Theoretical	3	50	0	0	18	50	3
9	Chemistry - II	BPCM 109	Theoretical	3	50	0	0	18	50	3
10	Chemistry - III	BPCM 110	Theoretical	3	50	0	0	18	50	3
11	Maths - I	BPCM 111	Theoretical	4	75	0	0	27	75	4
12	Maths - II	BPCM 112	Theoretical	4	75	0	0	27	75	4
13	Maths - III	BPCM 113	Theoretical	4	75	0	0	27	75	4
14	Computer Lab	BPCM 151	Practical	1	40	0	0	14	40	2
15	Physics Lab	BPCM 152	Practical	2	75	0	0	27	75	4
16	Chemistry Lab	BPCM 153	Practical	2	75	0	0	27	75	4
				34+8	**675**	**0**	**0**	**243**	**675**	**38+9**

L: *Lecture,* ***T:*** *Tutorial,* ***P:*** *Practical,* ***Cr:*** *Credits*

ETE: *End Term Exam,* ***IA:*** *Internal Assessment*

Course Name- B.Sc. (PCM) 1st Year	
Course Code- [BPCM 101]	
Credits-6 (L: 3 T: 1 P: 0)	
Course Outcomes (COs)	
B.Sc. (PCM) 1st Year	
Paper Name- General Hindi	
Students will be able to:	
CO 1	Describe Hindi morphology and syntax
CO 2	Explain grammatical rules and exceptions.
CO 3	Read and comprehend Hindi prose and poetry.
CO 4	Analyze literary devices and themes.
CO 5	Analyze literary devices and themes.
Course Outline (CO)	
1	Unit-1/ Hindi Language and Grammar /4 Hours Per Week
2	Unit-2/ Hindi Literature / 4 Hours Per Week
3	Unit-3/ Reading and Writing / 5 Hours Per Week
4	Unit-4/ Speaking and Listening / 5 Hours Per Week
5	Unit-5/ Applied Hindi /4 Hours Per Week
Detailed Syllabus	
Module-1	Hindi Language and Grammar: Hindi alphabet and pronunciation, Hindi grammar rules (sandhi, vachya, etc.), Hindi vocabulary (shabdaavali)
Module-2	Hindi Literature: Hindi poetry (kavya), Hindi prose (gadya), Hindi authors and their works (Bhakti movement, etc.)
Module-3	Reading and Writing: Hindi reading comprehension, Hindi composition writing (nibandh, etc.), Hindi letter writing (patra lekhan)
Module-4	Speaking and Listening: Hindi conversation skills, Hindi presentation skills, Hindi listening comprehension
Module-5	Applied Hindi: Hindi in everyday life, Hindi in science and technology, Hindi in literature and culture
Recommended Books	
	1. "Hindi Vyakaran aur Rachna" by Dr. S. C. Gupta (Publication: Lakshya Publication) 2. "Hindi Sahitya ka Itihas" by Dr. Ramchandra Shukla (Publication: Hindi Sahitya Sadan) 3. "Hindi Nibandh" by Dr. O. P. Singh (Publication: Kitab Mahal) 4. Hindi Vyakaran" by Dr. S. K. Mishra (Publication: Bharati Bhawan) 5. "Hindi Rachna" by Dr. L. N. Sharma (Publication: Lakshya Publication) 6. "Hindi Sahitya ka Swaroop" by Dr. R. C. Sharma (Publication: Hindi Sahitya Sadan)

Course Name- B.Sc. (PCM) 1st Year	
Course Code- [BPCM 102]	
Credits-6 (L: 3 T: 1 P: 0)	
Course Outcomes (COs)	
B.Sc. (PCM) 1st Year	
Paper Name- General English	
Students will be able to:	
CO 1	Understand the basics of English grammar, vocabulary, and syntax.
CO 2	Recognize various literary and non-literary texts, including fiction, non-fiction, poetry, and drama.
CO 3	Identify and analyze different writing styles, tone, and purposes.
CO 4	Familiarize themselves with linguistic and cultural nuances.
CO 5	Use language effectively in academic, scientific, and professional situations**.**
Course Outline (CO)	
1	Unit-1/ Comprehension and Vocabulary /4 Hours Per Week
2	Unit-2/ Composition / 4 Hours Per Week
3	Unit-3/ Grammar and Usage/ 5 Hours Per Week
4	Unit-4/ Reading Comprehension / 5 Hours Per Week
5	Unit-5/ Communication Skills /4 Hours Per Week
Detailed Syllabus	
Module-1	Comprehension and Vocabulary: a. Questions based on content from the prescribed text b. Questions based on a passage from the prescribed text to test the candidate's comprehension and vocabulary c. Questions based on an unseen passage to test the candidate's Comprehension and vocabulary (There will be a text of essays and short stories between 100 and in length.)
Module-2	Composition a. Letter/Application writing 10 Marks b. Paragraph writing/Précis writing 10 Marks c. Report Writing
Module-3	Grammar and Usage The Questions in this exercise will be set with the purpose of testing the candidate's knowledge of grammar and familiarity with correct usage. A. Elements of sentence B. Transformation of Sentences C. Active and Passive Voice D. Modals E. Determiners F. Common Errors in English
Module-4	Reading Comprehension: Fiction (short stories, novels), Non-fiction (essays, articles) Poetry, Writing Skills: Essay writing, Report writing, Creative writing

	Module-5	Communication Skills: Verbal communication, Non-verbal communication, Group discussions Literary Analysis: Literary devices (metaphor, simile, etc.) Themes and characters, Critical thinking and analysis
Recommended Books		
		1. General English" by various authors (Lakshya Publication) 2. "English Language and Literature" by S. K. Singh (Kitab Mahal) 3. "English Grammar and Composition" by Wren and Martin (S. Chand Publishing)

Course Name- B.Sc. (PCM) 1st Year

Course Code- [BPCM 103]

Credits-6 (L: 3 T: 1 P: 0)

Course Outcomes (COs)

B.Sc. (PCM) 1st Year

Paper Name- Environmental Studies

Students will be able to:

CO 1	Remembering: Recall environmental concepts, laws, and policies.
CO 2	Understanding: Interpret environmental issues and their impact.
CO 3	Applying: Use environmental knowledge to solve problems.
CO 4	Analyzing: Evaluate environmental information and develop solutions.
CO 5	Creating: Develop innovative solutions to environmental challenges.

Course Outline (CO)

1	Unit-1/ Reference systems /4 Hours Per Week
2	Unit-2/ Origin of the quantum theory / 4 Hours Per Week
3	Unit-3/ Quantum Mechanics / 5 Hours Per Week
4	Unit-4/ Structure of nuclei / 5 Hours Per Week
5	Unit-5/ Reference systems /4 Hours Per Week

Detailed Syllabus

Module-1	Introduction to Environmental Studies : Environment and ecology, Ecosystems and biodiversity, Environmental importance, Environmental challenges
Module-2	Human Impact on the Environment : Pollution (air, water, soil), Climate change and global warming, Deforestation and land degradation, Human population and environment, Environmental health
Module-3	Human Impact on the Environment: Pollution (air, water, soil), Climate change and global warming, Deforestation and land degradation, Human population and environment, Environmental health
Module-4	Environmental Policies and Issues : Environmental laws and regulations, International environmental agreements (Kyoto Protocol, etc.), National Environmental Policy (NEP), Environmental movements and organizations

	Module-5	VALUE OF BIODIVERSITY: CONSUMPTIVE, PRODUCTIVE USE, SOCIAL, ETHICAL, AESTHETIC AND OPTION VALUES : Consumptive value, Productive value, Social value, Ethical value, Aesthetic value, Option value
Recommended Books		
		1. Environmental Studies" by Erach Bharucha (University of Pune) 2. "Environmental Studies: A Practical Approach" by R. C. Trivedy and M. P. Singh (Tata McGraw-Hill) 3. "Environmental Science" by M. K. Jha (Vikas Publishing House) 4. "Environmental Studies: Principles and Practice" by D. D. Kapur and R. C. Trivedy (New Age International) 5. "Environmental Science and Technology" by J. L. Rao (S. Chand Publishing) 6. "Environmental Ecology" by P. D. Sharma (Rastogi Publications)

Course Name- Elementary Computer

Course Code- BPCM 104

Credits-6 (L: 3 T: 1 P: 0)

Course Outcomes (COs)

B.Sc. (PCM) 1st Year

Paper Name- Elementary Computer

Students will be able to:

CO 1	Define environmental studies and its scope.
CO 2	Identify the components of the natural environment (air, water, soil, biodiversity).
CO 3	Explain human impact on the environment (pollution, climate change, deforestation).
CO 4	Describe environmental laws, policies, and regulations.
CO 5	Define environmental studies and its scope.

Course Outline (CO)

1	Unit-1/ Introduction /4 Hours Per Week
2	Unit-2/ Computer Fundamentals / 4 Hours Per Week
3	Unit-3/ Programming Basics / 5 Hours Per Week
4	Unit-4/ Computer Applications / 5 Hours Per Week
5	Unit-5/ Manage an email account /4 Hours Per Week

Detailed Syllabus

Module-1	Introduction: objective, scope and outcome of the course.
Module-2	Computer Fundamentals: Computer hardware and software, Data representation and storage, Input/output devices, Computer networking, Computer security, Emerging trends

	Module-3	Programming Basics: Introduction to programming, Data types and variables, Control structures (if-else, loops), Functions and modules, Arrays and strings, File handling, Basic programming using C/Python
	Module-4	Computer Applications : MS Office (Word, Excel, PowerPoint), Internet and email basics, Web browsing and search engines, Online safety and security, Basic graphic design, Spreadsheet analysis, Presentation skills, Collaborative document editing
	Module-5	Manage an email account: E mail address, Configure E-mail Account, Log to an Email, Receive & send email, Sending files & attachment & address book, Downloading files, Online form filling, E-services, E-banking & E- Learning

Recommended Books

1. "Computer Fundamentals" by P. K. Sinha (BPB Publications)
2. "Introduction to Computers" by Peter Norton (McGraw-Hill Education)
3. "Computer Science" by Timothy J. Barth (Cengage Learning)
4. "Computer Organization and Architecture" by William Stallings (Pearson Education)
5. "Data Structures and Algorithms" by Alfred V. Aho (Addison-Wesley)
6. "Computer Networks" by Andrew S. Tanenbaum (Prentice Hall)

Course Name- B.Sc. (PCM) 1st Year

Course Code- [BPCM 105]

Credits-6 (L: 3 T: 1 P: 0)

Course Outcomes (COs)

B.Sc. (PCM) 1st Year

Paper Name- Physics-I

Students will be able to:

CO 1	Describe the fundamental laws of mechanics (Newton's laws, energy, momentum).
CO 2	Explain the concepts of motion (kinematics, dynamics).
CO 3	Apply mathematical techniques (calculus, algebra) to solve physics problems.
CO 4	Identify and analyze physical systems (oscillations, waves).
CO 5	Analyze and interpret experimental data

Course Outline (CO)

1	Unit-1/ Introduction /4 Hours Per Week
2	Unit-2/ Mechanics / 4 Hours Per Week
3	Unit-3/ Mathematical Methods / 5 Hours Per Week
4	Unit-4/ Thermodynamics / 5 Hours Per Week
5	Unit-5/ Oscillations and Waves /4 Hours Per Week

Detailed Syllabus

Module-1	**Introduction: objective, scope and outcome of the course.**

	Module-2	Mechanics : Kinematics (motion, velocity, acceleration), Dynamics (Newton's laws, force, energy), Work, energy, and power, Momentum and collisions, Rotational motion and gravity, Simple harmonic motion
	Module-3	Mathematical Methods : Calculus (differential equations, integrals), Vector algebra (vector operations, products), Coordinate systems (Cartesian, polar), Mathematical modeling in physics
	Module-4	Thermodynamics : Temperature and heat transfer, Laws of thermodynamics (Zeroth, First, Second), Thermodynamic systems and processes, Heat engines and refrigerators, Kinetic theory of gases
	Module-5	Oscillations and Waves: Simple harmonic motion, Damped and forced oscillations, Wave motion (types, superposition), Sound waves and acoustics, Electromagnetic waves
Recommended Books		
		1. University Physics" by Samuel J. Ling et al. (Pearson Education) 2. "Physics for Scientists and Engineers" by Paul A. Tipler (W.H. Freeman and Company) 3. "Concepts of Physics" by H.C. Verma (Bharati Bhawan) 4. Physics" by David Halliday, Robert Resnick, and Jearl Walker (Wiley-Interscience) 5. "Fundamentals of Physics" by John R. Gordon (Cengage Learning) 6. "Physics: Principles and Applications" by Douglas C. Giancoli (Pearson Education

Course Name- B.Sc. (PCM) 1st Year

Course Code- [BPCM 106]

Credits-6 (L: 3 T: 1 P: 0)

	Course Outcomes (COs)	
	B.Sc. (PCM) 1st Year	
	Paper Name- Physics-II	
	Students will be able to:	
	CO 1	Explain electromagnetic waves and their properties.
	CO 2	Describe electric and magnetic fields.
	CO 3	Apply Maxwell's equations to solve problems.
	CO 4	Understand optics and wave optics.
	CO 5	Applying: Use physics knowledge to solve problems.
	Course Outline (CO)	
	1	Unit-1/ Introduction /4 Hours Per Week
	2	Unit-2/ Electricity / 4 Hours Per Week
	3	Unit-3/ Magnetism / 5 Hours Per Week
	4	Unit-4/ Optics / 5 Hours Per Week
	5	Unit-5/ Mathematical Methods: /4 Hours Per Week
	Detailed Syllabus	
	Module-1	Introduction to objective, scope and outcome of the course.

	Module-2	Electricity :Electric charges and fields, Electric potential and circuits, Resistance and conductivity, Capacitance and dielectrics, Electric current and circuits, DC and AC circuits
	Module-3	Magnetism: Magnetic fields and forces, Magnetic materials and properties, Electromagnetic induction, Alternating current circuits, Magnetic measurements
	Module-4	Optics : Wave optics and interference, Ray optics and reflection, Refraction and total internal reflection, Optical instruments (mirrors, lenses), Diffraction and polarization Optical measurements
	Module-5	Mathematical Methods: Vector calculus, Differential equations, Fourier analysis, Mathematical modeling in physics

Recommended Books

		1. University Physics" Vol. 2 by Samuel J. Ling et al. (Pearson Education) 2. "Physics for Scientists and Engineers" Vol. 2 by Paul A. Tipler (W.H. Freeman and Company) 3. "Concepts of Physics" Vol. 2 by H.C. Verma (Bharati Bhawan) 4. "Electricity and Magnetism" by Edward M. Purcell (Cambridge University Press) 5. "Optics" by Eugene Hecht (Addison-Wesley) 6. "Waves and Oscillations" by Walter Fox Smith (Oxford University Press

Course Name- B.Sc. (PCM) 1st Year

Course Code- [BPCM 107]

Credits-6 (L: 3 T: 1 P: 0)

	Course Outcomes (COs)	
	B.Sc. (PCM) 1st Year	
	Paper Name- Physics III	
	Students will be able to:	
	CO 1	Explain wave-particle duality and uncertainty principle.
	CO 2	Describe quantum mechanics principles (Schrödinger equation, wave functions).
	CO 3	Apply statistical mechanics to thermodynamic systems.
	CO 4	Understand selected topics in modern physics (relativity, nuclear physics).
	CO 5	Apply mathematical modelling to quantum systems
	Course Outline (CO)	
	1	Unit-1/ Introduction /4 Hours Per Week
	2	Unit-2/ Quantum Mechanics / 4 Hours Per Week
	3	Unit-3/ Atomic Physics / 5 Hours Per Week
	4	Unit-4/ Nuclear Physics / 5 Hours Per Week
	5	Unit-5/ Mathematical Methods /4 Hours Per Week
	Detailed Syllabus	
	Module-1	Introduction to objective, scope and outcome of the course

	Module-2	Quantum Mechanics : Wave-particle duality, Uncertainty principle, Schrödinger equation, Quantum harmonic oscillator, Quantum mechanics applications
	Module-3	Atomic Physics : Atomic structure, Electron spin and magnetic moment, X-ray spectra, Atomic collisions, Atomic physics applications
	Module-4	Nuclear Physics: Nuclear structure, Radioactive decay, Nuclear reactions, Nuclear energy, Nuclear physics applications
	Module-5	Mathematical Methods : Differential equations, Group theory, Vector calculus, Mathematical modeling in physics

Recommended Books

		1. University Physics" Vol. 3 by Samuel J. Ling et al. (Pearson Education) 2. "Physics for Scientists and Engineers" Vol. 3 by Paul A. Tipler (W.H. Freeman and Company) 3. "Concepts of Physics" Vol. 3 by H.C. Verma (Bharati Bhawan) 4. "Quantum Mechanics" by Lev Landau (Pergamon Press) 5. "Solid State Physics" by J. S. Blakemore (Cambridge University Press) 6. "Nuclear Physics" by S. B. Patel (Tata McGraw-Hill)

Course Name- B.Sc. (PCM) 1st Year

Course Code- [BPCM 108]

Credits-6 (L: 3 T: 1 P: 0)

	Course Outcomes (COs)	
	B.Sc. (PCM) 1st Year	
	Paper Name- Chemistry – I	
	Students will be able to:	
	CO 1	Describe atomic structure and periodic trends.
	CO 2	Explain chemical bonding theories (ionic, covalent, metallic).
	CO 3	Identify and classify main group elements.
	CO 4	Understand acid-base chemistry.
	CO 5	Analyze and interpret chemical data
	Course Outline (CO)	
	1	Unit-1/ Introduction /4 Hours Per Week
	2	Unit-2/ Ionic solids / 4 Hours Per Week
	3	Unit-3/ Covalent Bond / 5 Hours Per Week
	4	Unit-4/ S-Block Elements / 5 Hours Per Week
	5	Unit-5/ Important Compounds of P block Elements /4 Hours Per Week
	Detailed Syllabus	

	Module-1	Introduction to objective, scope and outcome of the course
	Module-2	Ionic solids: Ionic structures, radius ratio, effects & coordination number, limitation of radius ratio rule, lattice defects, semiconductors, Lattice energy & born Haber cycle Solvation energy & solubility of ionic solids, polarizing power & polarisability of ions Metallic bond: Free electron, Valence bond & bond theories Weak Interaction: Hydrogen bonding, vander wall forces
	Module-3	Covalent Bond: Valence bond theory & its limitations, directional & shapes of simple inorganic molecules & ions, valence shell electro pair repulsion (VSPER) theory to NH_3. H_3O^+, SF_4 , CIF_3, ICL_2, H_2O Molecular Orbital theory: homonuclear & hetronuclear (CO & NO) diamond molecules, Multicenter bonding in electron deficient molecules, bond strength & bond energy, percentage ionic character of dipole moment & electronegativity difference
	Module-4	S-Block Elements: Comparative study, diagonal relationships, silent features of hydrides, solvation & complexion tendencies including their function in biosystem, an introduction to alkyls & aryls Periodicity of P block elements, reference to atomic & ionic radii, ionization energy, electron affinity, electron energy diagonal relationship, catenation
	Module-5	Important Compounds of P block Elements: Hydrides of boron, diborane & higher Borane, Borazine, Borohydrides, fullerenes, carbides, fluorocarbons, silicates (structural principal), tetrasulphar, tetranitride, basic properties of halogen, Interhalogens & polyhalides Chemistry of noble gases: Chemical properties of noble gases, chemistry of xenon, structure & bonding of xenon compounds

Recommended Books

		1. "Physical Chemistry" by Peter W. Atkins (Oxford University Press) 2. "Physical Chemistry" by Thomas Engel and Philip Reid (Pearson Education) 3. "Physical Chemistry: A Molecular Approach" by D. A. McQuarrie and J. D. Simon (University Science Books) 4. "Physical Chemistry: An Introduction" by J. M. Seddon and J. D. Gale (Oxford University Press) 5. "Physical Chemistry: Principles and Applications" by R. K. Yalamanchili (New Age International)

Course Name- B.Sc. (PCM) 1st Year

Course Code- [BPCM 109]

Credits-6 (L: 3 T: 1 P: 0)

Course Outcomes (COs)

B.Sc. (PCM) 1st Year

Paper Name- Chemistry – II

Students will be able to:

CO 1	Describe classification and nomenclature of organic compounds.
CO 2	Explain structural and stereochemical principles.
CO 3	Identify and analyze functional groups.
CO 4	Understand basic organic reactions.

	CO 5	Analyze and interpret organic spectra
	Course Outline (CO)	
	1	Unit-1/ Introduction to objective /4 Hours Per Week
	2	Unit-2/ Mechanism of Organic Reactions / 4 Hours Per Week
	3	Unit-3/ Stereochemistry of Organic compounds / 5 Hours Per Week
	4	Unit-4/ Alkanes & Cycloalkanes / 5 Hours Per Week
	5	Unit-5/ Isolated conjugated & cumulated dienes /4 Hours Per Week
	Detailed Syllabus	
	Module-1	**Introduction to objective, scope and outcome of the course.**
	Module-2	Mechanism of Organic Reactions: Homolytic & Hetrolytic bonds , Clevage type of regents, electrophiles & nucleophiles, Reactive intermediates- carbocations, free radicals, carbenes, arynes & nitrenes (with examples), Types of organic reactions, Energy considerations, Methods of determination of reaction mechanism, intermediates, isotrope effects, kinetic & stereo chemical studies)
	Module-3	Stereochemistry of Organic compounds : Concepts of isomerism, Types of isomerism, Difference between configuration & confirmation, Flying wedge & Fisher wedge Projection formulae Optical Isomerism: Elements of symmetry, molecular chirality, enantiomers, stereogenicenters, Optical activities, Properties of enantiomers, chiral & achiral molecules with two streriogenic centers, Disastereomers, Resolution of enantiomers, Inversion, retention & racemization, Z system of nomenclature, Geometric Isomerism in oximes & alicyclic compounds Conformal Isomerism: Newman Projection & Sawhorse Formulae, Conformal analysis of ethane, n-butane Cyclohexane
	Module-4	Alkanes & Cycloalkanes: IUPAC Nomenclature of branched & unbranched alkyl group, classification of carbon atoms in alkanes, Methods of formations, Kolbe reaction, Corey House reaction & decarboxylation, Physical properties & chemical reactions of alkanes, Mechanism of free radicals, Reactivity & selectivity, Cycloalkanes- nomenclature methods of formation, chemical reactions, Baeyer's strain Theory & its limitations, Theory of stainless rings Alkenes, Cycloalkenes, Dienes & Alkynes: Methods of Formation, mechanism of dehydration of alcohols & dehydrohelogenation of alkyl hailides, Regioselectivity of Alcohol dehydration- the saytzeff rule, Hoffmen elimination, Physical properties & relative stabilities, Chemical reaction of alkenes- mechanism involved in hydrogenation, electrophilic & free radical additions, Markownikoff 's rule, hydroboration & oxidation with $KMnO_4$, Polymerization of alkenes, Substitution of alicyclic & vinylic position of alkenes
	Module-5	Classification & nomenclature of isolated conjugated & cumulated dienes, Method of formation properties, Structure & bonding of alkynes, Methods of formation, Chemical reactions- acidity of alkynes, mechanism of electrophilic & nucleophilic addition reactions, hydroboration oxidation, metal ammonia reduction, Oxidation & polymerization

Recommended Books

		1. "Inorganic Chemistry" by James E. Huheey (HarperCollins Publishers) 2. "Inorganic Chemistry" by Gary L. Miessler and Donald A. Tarr (Pearson Education) 3. Inorganic Chemistry: Principles and Applications" by R. K. Yalamanchili (New Age International) 4. "Inorganic Chemistry: A Unified Approach" by R. L. DeKock and T. P. Gray (McGraw-Hill Education) 5. Organic Chemistry" by Jerry March et al. (Wiley-Interscience) 6. "Organic Chemistry" by Francis A. Carey and Richard J. Sundberg (McGraw-Hill Education) 7. Physical Chemistry" by Thomas Engel and Philip Reid (Pearson Education)

Course Name- B.Sc. (PCM) 1st Year

Course Code- BPCM 110

Credits-6 (L: 3 T: 1 P: 0)

Course Outcomes (COs)

B.Sc. (PCM) 1st Year

Paper Name- Chemistry – III

Students will be able to:

CO 1	Describe classification and nomenclature of organic compounds.
CO 2	Explain structural and stereochemical principles.
CO 3	Identify and analyze functional groups.
CO 4	Understand basic organic reactions.
CO 5	Apply mathematical models to physical chemistry problems.

Course Outline (CO)

1	Unit-1/ Introduction /4 Hours Per Week
2	Unit-2/ Mathematical Concepts / 4 Hours Per Week
3	Unit-3/ Gaseous States / 5 Hours Per Week
4	Unit-4/ Solid States / 5 Hours Per Week
5	Unit-5/ Colloidal States /4 Hours Per Week

Detailed Syllabus

Module-1	**Introduction to objective, scope and outcome of the course.**
Module-2	Mathematical Concepts: Logarithmic relations, Curve sketching, Linear graphs & calculation of slopes, Differentiation of function like k_x, e^x, x^n , sinx & log x, maxima & minima, Integration of some useful functions, Permutation & combination's, Factorials & Probability Liquid state: Intermolecular forces, Structure of liquids, Structural differentiation between solid, liquid & gases, Liquid crystals: Difference between liquid crystal, solid & liquid, Thermography & 7 segment cells.

	Module-3	Gaseous States: Definition and properties of gases, Gas laws (Boyle's, Charles', Avogadro's), Ideal Gas Equation, Real gases and deviations from ideality, Applications of gas laws Kinetic Theory of Gases: Molecular structure and intermolecular forces, Maxwell-Boltzmann distribution, Kinetic energy and temperature, Collisions and mean free path, Transport phenomena (diffusion, viscosity), Thermal conductivity and heat transfer, Kinetic theory of gas mixtures
	Module-4	Solid States: Introduction to Solids, classification of solids, Crystal structures and unit cells, Lattice parameters and crystal systems Crystal Structures: Bravais lattices and crystal systems, Miller indices and lattice planes, Crystal symmetry and point groups, Space groups and crystal structures, Defects in crystal structures Bonding in Solids : Ionic bonding and electrostatic forces, Covalent bonding and molecular orbitals, Metallic bonding and free electron model, Hydrogen bonding and van der Waals forces, Bonding in semiconductors
	Module-5	Colloidal States: Introduction, Definition and importance of colloids, Types of colloids (lyophobic, lyophilic), Preparation methods (condensation, dispersion) Properties of Colloids: Brownian motion and sedimentation, Electrokinetic phenomena (electrophoresis, electroosmosis), Interfacial tension and surface energy, Viscosity and rheology of colloids

Recommended Books

		1. Physical Chemistry: A Molecular Approach" by D. A. McQuarrie and J. D. Simon (University Science Books) 2. "Physical Chemistry" by Peter W. Atkins (Oxford University Press) 3. "Physical Chemistry: Principles and Applications" by R. K. Yalamanchili (New Age International) 4. "Advanced Inorganic Chemistry" by Cotton and Wilkinson (Wiley-Interscience) 5. "Inorganic Chemistry: Principles and Applications" by R. K. Yalamanchili (New Age International) 6. "Inorganic Chemistry" by Gary L. Miessler and Donald A. Tarr (Pearson Education)

Course Name- B.Sc. (PCM) 1st Year

Course Code- BPCM 111

Credits-6 (L: 3 T: 1 P: 0)

Course Outcomes (COs)

B.Sc. (PCM) 1st Year

Paper Name- Math-I

Students will be able to:

CO 1	Define limits, derivatives, and integrals.
CO 2	Explain vector algebra and matrix operations.
CO 3	Describe sequences and series convergence.

	CO 4	Understand differential equations.
	CO 5	Analyze and interpret mathematical data.
	Course Outline (CO)	
	1	Unit-1/ Introduction /4 Hours Per Week
	2	Unit-2/ Sets theory / 4 Hours Per Week
	3	Unit-3/ Boolean Algebra / 5 Hours Per Week
	4	Unit-4/ Logic & Propositional calculus / 5 Hours Per Week
	5	Unit-5/ Basic concepts of Graph Theory /4 Hours Per Week
	Detailed Syllabus	
	Module-1	**Introduction to objective, scope and outcome of the course.**
	Module-2	Sets, Cardinality, Principal of Inclusion & exclusion, Mathematical Induction, Relations & Functions, Binary Relations, Equivalence relations & participations, Partial order relations & Lattices, Chains & AntiChains, Pigeon hole & principle
	Module-3	Boolean Algebra: Lattices & Algebraic structure: Duality, Distributive & complemented Lattices, Boolean Lattices, Boolean function & Boolean expression, Fundamental theorem of Arithmetic, Divisibility in Z, Congruence's, Chinese reminder theorem, Euler's Functions, Primitive roots
	Module-4	Logic & Propositional calculus, Simple & compound propositions, Basic logical operations, Truth Tables, propositional Functions, Discrete numeric functions, Generating Functions, Recurrence Algorithm, Total solutions, Solution by generating functions
	Module-5	Basic concepts of Graph Theory, Types of Graphs, Walk, Path & Circuits, Short path Problem, Operations on graphs
Recommended Books		
		1. Calculus" by Michael Spivak (Cambridge University Press) 2. "Calculus: Early Transcendentals" by James Stewart (Cengage Learning) 3. "Calculus" by Thomas/Finney (Addison-Wesley) 4. "Linear Algebra and Its Applications" by Gilbert Strang (Cengage Learning) 5. "Linear Algebra" by David C. Lay (Pearson Education) 6. "Linear Algebra: A Modern Introduction" by David Poole (Cengage Learning)

Course Name- B.Sc. (PCM) 1st Year

Course Code- [BPCM 112]

Credits-6 (L: 3 T: 1 P: 0)

	Course Outcomes (COs)	
	B.Sc. (PCM) 1st Year	
	Paper Name- Math-II	
	Students will be able to:	
	CO 1	Apply integration techniques (improper integrals, parametric integrals).

	CO 2	Explain vector calculus (gradient, divergence, curl).
	CO 3	Describe differential equations (separation of variables, integrating factors).
	CO 4	Understand complex analysis (Cauchy-Riemann equations).
	CO 5	Analyze and interpret mathematical data

Course Outline (CO)

	1	Unit-1/ Introduction /4 Hours Per Week
	2	Unit-2/ Series / 4 Hours Per Week
	3	Unit-3/ Derivative of length of an arc / 5 Hours Per Week
	4	Unit-4/ Envelopes & evolutes / 5 Hours Per Week
	5	Unit-5/ Beta & Gamma functions /4 Hours Per Week

Detailed Syllabus

	Module-1	Introduction to objective, scope and outcome of the course
	Module-2	Series- Infinite series & Convergent series, Test for Convergence of a series, Comparison test, D'Alembert ratio test, Cauchy's n^{th} rule test, Rabbe's Test, De-Morgan Bertrand's test, Cauchy's condensation test, Gauss's Test, Alterative series, Absolute Convergence, Taylor's theorem, Maclaurin's theorem's, Power series expansion of a function, Power series expansion of sinx, cosx, e^x, $\log_e(1+x)$,$(1+x)^n$
	Module-3	Derivative of length of an arc, Pedal equation, Curvature- Various formulae, Centre of curvature & chord of curvature, Partial differentiation, Total differentiation, Differentiation of implicit functions
	Module-4	Envelopes & evolutes, Maxima & minima of function of two variables, Lagrange's method of undetermined multipliers, Asymptotes, Multiple points, Curve tracing of standard curves (Cartesian & polar curves)
	Module-5	Beta & Gamma functions, Reduction Formulae, Double Integrals in Cartesian & Polar Coordinates, Change of order of Integration, Triple Integrals, Dirichlet's Integrals

Recommended Books

1. Complex Analysis" by Serge Lang (Springer)
2. "Complex Analysis" by Elias M. Stein and Rami Shakarchi (Princeton University Press)
3. Vector Calculus, Linear Algebra, and Differential Forms" by John H. Hubbard (Prentice Hall)
4. "Vector and Tensor Analysis" by Lawrence E. Malvern (Wiley-Interscience)
5. Abstract Algebra" by David S. Dummit and Richard M. Foote (Wiley-Interscience)
6. "Algebra" by Michael Artin (Prentice Hall)
7. "Contemporary Abstract Algebra" by Joseph A. Gallian (Cengage Learning)

Course Name- B.Sc. (PCM) 1st Year

Course Code- [BPCM 113]

Credits-6 (L: 3 T: 1 P: 0)

Course Outcomes (COs)

	B.Sc. (PCM) 1st Year	
	Paper Name- Math-III	
	Students will be able to:	
	CO 1	Explain partial differential equations (PDEs) and their applications.
	CO 2	Describe advanced calculus topics (measure theory, Lebesgue integration).
	CO 3	Apply group theory and ring theory to solve problems.
	CO 4	Understand numerical methods for solving mathematical problems.
	CO 5	Analyze and interpret mathematical data using statistical methods
	Course Outline (CO)	
	1	Unit-1/ Introduction /4 Hours Per Week
	2	Unit-2/ Probability theory / 4 Hours Per Week
	3	Unit-3/ Random variables / 5 Hours Per Week
	4	Unit-4/ Mathematical Expectations / 5 Hours Per Week
	5	Unit-5/ Univariate discrete distribution /4 Hours Per Week
	Detailed Syllabus	
	Module-1	Introduction to objective, scope and outcome of the course
	Module-2	Probability theory: Important concepts of probability: Random experiment, Trial, Events & its types, Definitions of probability, Sample point & sample space, Axiomatic approach of Probability & its properties, Addition & multiplication theorem of Probability, Conditional Probability, Bayes theorem & its applications,
	Module-3	Random variables: Definition with illustrations, Types of Random variables, Probability Mass function, Probability Density function, Distribution function & its property, Joint probability distribution, Marginal & Conditional probability distribution & its density functions, hebychev's Inequality & its applications
	Module-4	Mathematical Expectations: Expectations of a Random variables & its simple properties, Addition & Multiplication theorem of Expectations, Conditional Expectation, Definition of variance , covariance & its properties, Raw & central moments
	Module-5	Univariate discrete distribution & its properties, Bernoulli's distribution, Binomial distribution, Poisson's distribution,
Recommended Books		

		1. Discrete Mathematics" by Kenneth H. Rosen (McGraw-Hill) 2. "Discrete Mathematics and Its Applications" by Norman L. Biggs (Springer) 3. "Discrete Mathematics: An Introduction" by John A. Dossey (McGraw-Hill) 4. An Introduction to the Theory of Numbers" by G.H. Hardy and E.M. Wright (Oxford University Press) 5. "Number Theory" by Henryk Iwaniec and Emmanuel Kowalski (American Mathematical Society

Computer Lab [BPCM 151]

Credit 1 **Max. Marks: 100(IA: 60, ETE:40)**
0L+0T+2P

List of Experiments	
1	Computer Fundamentals: Introduction to computers, Hardware and software components, Operating systems (Windows, Linux), Basic computer architecture
2	Programming in Python : Introduction to Python, Variables, data types, and operators Control structures (loops, conditional statements), Functions and modules, Lists, tuples, and dictionaries, File handling and input/output operations
3	Object-Oriented Programming (OOP) concepts using Python, Error handling and debugging, Python libraries (NumPy, Pandas), Data visualization using Matplotlib, Case studies and projects
4	Numerical Computing : Numerical methods for algebraic equations, Numerical differentiation and integration, Numerical solutions of ordinary differential equations
5	Interpolation and extrapolation: Data analysis and visualization, Numerical methods for partial differential equations, Case studies and projects

Physics Lab [BPCM 152]

Credit 1 **Max. Marks: 100(IA: 60, ETE:40)**
0L+0T+2P

List of Experiments	
1	Study the variation of time period with amplitude in large angle oscillations using a compound pendulum
2	To study the damping using a compound pendulum
3	To study the excitation of normal modes & measure frequency splitting into two coupled oscillators
4	To study the viscous fluid damping of a compound pendulum & determine the damping coefficient & Q of the oscillators
5	Study of the normal modes of coupled pendulum system
6	Study of oscillations of mixed modes & find the period of energy exchange between the two oscillators
7	To determine Young's modulus by bending of the beam

8	To determine modulus of rigidity of a wire using Maxwell's needle
9	To determine moment of inertia of a flywheel
10	To determine motion of the spring & calculate (a) spring constant (b) Modulus of Rigidity

Chemistry Lab [BPCM 153]

Credit 1 **Max. Marks: 100(IA: 60, ETE:40)**
0L+0T+2P

List of Experiments	
1	Separation & identifications of 6 radical's in the give inorganic mixture including spatial combinations
2	Determine the melting point (naphthalene, benzoic acid, urea etc.) boiling point (methanol, ethanol, cyclohexane etc.) mixed melting point (urea, cinnamic acid etc.)
3	Determine the specific reaction rate of the hydrolysis of methyl acetate/ ethyl acetate catalyzed by hydrogen ions at room temperature
4	To study the effect of acid strength on the hydrolysis of an ester
5	To compare the strength of HCL & H_2SO_4 by studying the kinetics of hydrolysis of ethyl acetate
6	To study kinetically the reaction rate of decomposition of iodide by H_2O_2
7	To determine the viscosity/ surface tension of pure liquid (alcohol etc.) at room temperature.
8	To determine the percentage composition of a given binary mixture by surface tension method
9	To determine the percentage composition of a given binary mixture by viscosity method

UNDERGRADUATE DEGREE COURSE

B.Sc. (PCM) 2nd Year

University of Technology

Vatika Road, Jaipur Rajasthan 303903

Course Name- B.Sc (PCM) - 2nd Year		
Course Code- BPCM 205		
Credits-6 (L-18 h/T-18h)		
	Course Outcomes (COs)	
	B.Sc (PCM) - 2nd Year	
	BPCM 205: Physics - I	
	Students will be able to:	
	CO 1	Explain Maxwell's equations and their applications
	CO 2	Describe electromagnetic waves and their properties.
	CO 3	Understand electromagnetic induction and its applications.
	CO 4	Analyze electric and magnetic fields in various configurations.
	CO 5	Analyze and interpret experimental data related to electromagnetism.
	Course Outline (CO)	
	1	**Unit-1/** Introduction **/4 Hours Per Week**
	2	**Unit-2/** Thermal & adiabatic interaction **/ 4 Hours Per Week**
	3	**Unit-3/** Production of law temperatures & its applications **/ 5 Hours Per Week**
	4	**Unit-4/** Classical statics **/ 5 Hours Per Week**
	5	**Unit-5/** Quantum Statics **/ 5 Hours Per Week**
	Detailed Syllabus	
	Module-1	Introduction to objective, scope and outcome of the course.
	Module-2	Thermal & adiabatic interaction: Thermal interaction, Zeroth Law of thermodynamics, System in thermal contact with a heat reservoir, Energy fluctuations, Entropy of a system in heat bath, Helmholtz free energy, Adiabatic interaction & enthalpy, General interaction of 1st law of thermodynamics, Infinitesimal general interaction, Gibb's free energy, Phase transition, Clausius claypeyron equation, Vapour pressure curve, Heat engine & efficiency of heat engine, Carnot's cycle, Thermodynamics scale as an absolute scale, Maxwell relations & its applications

	Module-3	Production of law temperatures & its applications: Joule Thomson expansion, Porous plug experiment, Temperature Inversion, Regenerative cooling, Cooling by adiabatic expansion & demagnetization, Liquid Helium, He I & He II, superfluidity, Refrigeration through He dilution, Quest for absolute zero Transform phenomena: Mean Free Path, distribution of free paths, coefficients of viscosity, thermal conductivity, diffusion & their thermal interaction
	Module-4	Classical statics: Forces and Equilibrium , Force systems (coplanar, non-coplanar), Equilibrium conditions (translational, rotational), Moment of a force and torque, Couples and pure moments Equilibrium of particles and rigid bodies, Applications of equilibrium conditions, Force analysis in 2D and 3D, Frictional forces and applications
	Module-5	Quantum Statics : Time-independent Schrödinger equation, Quantum harmonic oscillator Quantum tunneling and barriers, Quantum wells and potentials, Quantum particles in 1D, 2D, and 3D, Degenerate and non-degenerate perturbation theory, Variational method, WKB approximation, Quantum chaos, Applications of quantum statics
	Module-6	Angular Momentum and Spin : Orbital angular momentum, Spin angular momentum, Total angular momentum, Clebsch-Gordan coefficients, Spin-orbit coupling, Applications of angular momentum
	Suggested Recommended Books: 1. Optics" by Eugene Hecht (Addison-Wesley) 2. "Optics" by John R. Bolton (McGraw-Hill) 3. "Thermodynamics" by C. B. P. Singh (New Age International) 4. "Thermodynamics: Principles and Applications" by C. S. Narasimhan (Tata McGraw-Hill)	

Course Name- B.Sc (PCM) - 2nd Year		
Course Code-[BPCM 207]		
Credits-6 (L-18 h/T-18h)		
	Course Outcomes (COs)	
	B.Sc. (PCM) - 2nd Year	
	BPCM 207: Physics - II	
	Students will be able to:	
	CO 1	Explain wave-particle duality and uncertainty principle
	CO 2	Describe Schrödinger equation and its applications.
	CO 3	Understand quantum mechanics principles (orbital, spin, momentum).
	CO 4	Analyze quantum systems (atoms, molecules, solids).
	CO 5	Analyze and interpret experimental data related to quantum physics
	Course Outline (CO)	
	1	**Unit-1/** Introduction **/4 Hours Per Week**
	2	**Unit-2/** Orthogonal curvilinear coordinate system **/ 4 Hours Per Week**
	3	**Unit-3/** Lorentz transformation **/ 5 Hours Per Week**
	4	**Unit-4/** Transformation of Electric and Magnetic Fields between Two Inertial Frames **/ 5 Hours Per Week**
	5	**Unit-5/** Relativistic Electromagnetism **/ 5 Hours Per Week**
	6	**Unit-6/** Wave equation in spherical polar coordinate system **/ 5 Hours Per Week**
	Detailed Syllabus	
	Module-1	Introduction to objective, scope and outcome of the course.
	Module-2	Orthogonal curvilinear coordinate system, Scale factors, expression for gradients, divergence, Circular cylindrical & spherical polar coordinates
	Module-3	Lorentz transformation, Length contraction, Time Dilation, Mass variation, Rotation in space time like & space like vector, world line, macro casuality, Four vector Formulation energy momentum four vector, relativistic equation of motion, Invariance of rest mass, Orthogonality of four force & four velocity, Transformation of four frequency vector, Longitudinal & transverse droplet effect

	Module-4	Transformation of Electric and Magnetic Fields between Two Inertial Frames: Electromagnetic Field Transformations , Transformation of electric and magnetic fields, Relativistic electric field equations, Relativistic magnetic field equations, Electromagnetic field invariants, Transformation of electromagnetic waves, Relativistic electromagnetic induction, Applications of EM field transformations, Limitations and approximations
	Module-5	Relativistic Electromagnetism : Relativistic electromagnetic waves, Electromagnetic radiation from moving charges, Relativistic electromagnetic scattering, Relativistic electromagnetic energy and momentum, Applications in particle physics and engineering, Advanced topics in relativistic electromagnetism
	Module-6	Wave equation in spherical polar coordinate system the vibration of a circular membrane, Diffusion equation in 2D Cartesian coordinate system heat conduction in a thin rectangular plate, Laplace equation in spherical coordinate system- electric potential around in spherical surface
	Suggested Recommended Books: 1. Solid State Physics: An Introduction" by Philip W. Anderson (Wiley-Interscience) 2. "Solid State Physics: Principles and Applications" by M. A. Omar (Springer) 3. Nuclear Physics" by S. B. Patel (Tata McGraw-Hill) 4. "Nuclear Physics" by Kenneth S. Krane (Wiley-Interscience) 5. "Introduction to Nuclear Physics" by John D. Bowman (University Science Books)	

Course Name- B.Sc (PCM) - 2nd Year		
Course Code-[BPCM 208]		
Credits-6 (L-18 h/T-18h)		
	Course Outcomes (COs)	
	B.Sc. (PCM) - 2nd Year	
	BPCM 208: Physics - III	
	Students will be able to:	
	CO 1	Explain laws of thermodynamics (zeroth, first, second, third).
	CO 2	Describe thermodynamic systems (ideal gas, real gas, phase transitions).
	CO 3	Understand statistical mechanics principles (microcanonical, canonical, grand canonical).
	CO 4	Analyze thermodynamic and statistical systems.
	CO 5	Solve numerical problems involving thermodynamics and statistical mechanics.

	Course Outline (CO)	
	1	**Unit-1/** Introduction **/4 Hours Per Week**
	2	**Unit-2/** Circuit Analysis **/ 4 Hours Per Week**
	3	**Unit-3/** Rectifier Circuits **/ 5 Hours Per Week**
	4	**Unit-4/ Transistor Fundamentals / 5 Hours Per Week**
	6	**Unit-5/ Transistor Biasing / 5 Hours Per Week**
	Detailed Syllabus	
	Module-1	Introduction to objective, scope and outcome of the course.
	Module-2	Circuit Analysis: Introduction to circuit analysis, Kirchhoff's laws, Nodal and mesh analysis Thevenin and Norton equivalents, Superposition theorem, Maximum power transfer theorem, AC circuit analysis, Phasors and impedance, AC circuit theorems, Applications of circuit analysis PN Junctions: PN junction formation, I-V characteristics of PN junctions, Types of PN junctions (Si, Ge, etc.), Rectifier circuits, Zener diodes and voltage regulation, PN junction applications (amplifiers, switches), Diode equivalent circuits, Advanced PN junction topics (tunnel diodes, etc.)
	Module-3	Rectifier Circuits : Introduction to rectifiers, Half-wave and full-wave rectifiers, Bridge rectifiers Rectifier efficiency and ripple factor, Filter circuits (RC, RL, RLC), Rectifier applications (power supplies, motor control), Rectifier protection circuits
	Module-4	Transistor Fundamentals : Transistor types (BJT, FET, MOSFET), Transistor characteristics (I-V, current gain), Transistor amplifiers (CE, CB, CC), Transistor equivalent circuits, Transistor biasing and stabilization, Transistor applications (amplifiers, switches), Transistor noise and thermal considerations, Transistor modeling and simulation, Advanced transistor topics (high-frequency transistors), Transistor reliability and testing
	Module-5	**Transistor Biasing:** Introduction to transistor biasing, Fixed bias and collector-to-base bias, Voltage divider bias, Bias stability and thermal considerations, Biasing techniques for power transistors **Transistor Amplifiers:** Common emitter configuration, Common collector configuration, Common base configuration, Amplifier analysis (voltage gain, current gain), Input/output impedance and matching, Frequency response and bandwidth, Multi-stage amplifiers, Feedback amplifiers, Differential amplifiers, Operational amplifiers (op-amps)

	Module-6	**Oscillators Circuits:** Introduction to oscillators, RC oscillators, LC oscillators, Crystal oscillators, Oscillator characteristics (frequency, stability), Oscillator applications (communication systems), Advanced oscillator topics (high-frequency oscillators), Oscillator design and testing **Logic Circuits :** Number systems (binary, decimal, hexadecimal), Logic gates (AND, OR, NOT) Combinational logic circuits, Sequential logic circuits, Flip-flops and counters, Registers and memory, Logic circuit design and testing, Troubleshooting techniques, Advanced logic topics (high-speed logic)
	Suggested Recommended Books: 1. "Quantum Field Theory" by Michael Peskin and Daniel V. Schroeder (Westview Press) 2. "Quantum Field Theory for the Gifted Amateur" by Tom Lancaster and Stephen J. Blundell (Oxford University Press) 3. "Computational Physics" by Nicholas J. Giordano (Prentice Hall) 4. "Computational Physics: Problem Solving with Python" by Ruben D. Ortiz and Francisco J. Rodriguez (CRC Press)	

Course Name- B.Sc. (PCM) - 2nd Year		
Course Code-[BPCM 208]		
Credits-6 (L-18 h/T-18h)		
	Course Outcomes (COs)	
	B.Sc. (PCM) - 2nd Year	
	[BPCM 208]: Chemistry-I	
	Students will be able to:	
	CO 1	Explain coordination compounds (structure, bonding, isomerism)
	CO 2	Describe transition metal chemistry (oxidation states, complexes).
	CO 3	Understand organometallic chemistry (structure, reactions).
	CO 4	Analyze biochemical applications of coordination compounds.
	CO 5	Apply chemical principles to predict reaction outcomes.
	Course Outline (CO)	
	1	**Unit-1/** Introduction **/4 Hours Per Week**
	2	**Unit-2/ Definition and scope of transition metals / 4 Hours Per Week**
	3	**Unit-3/ Introduction to 2nd and 3rd Transition Metals / 5 Hours Per Week**
	4	**Unit-4/ Introduction to Combination Compounds / 5 Hours Per Week**

	5	**Unit-5/ Lanthanides and Actinides / 5 Hours Per Week**
	Detailed Syllabus	
	Module-1	Introduction to objective, scope and outcome of the course.
	Module-2	Definition and scope of transition metals, Electronic configuration and oxidation states, General physical and chemical properties, Classification of transition metals Chemistry of Sc, Ti, V, Cr, Mn, Scandium, Titanium, Vanadium, Chromium, Manganese, Compounds and reactions of Sc, Ti, V, Cr, and Mn, Applications of Sc, Ti, V, Cr, and Mn, Trends and patterns in the chemistry of Sc, Ti, V, Cr, and Mn Chemistry of Fe, Co, Ni, Cu, and Zn : Chemistry of Iron, Cobalt, Nickel, Copper, Zinc, Compounds and reactions of Fe, Co, Ni, Cu, and Zn
	Module-3	Introduction to 2nd and 3rd Transition Metals : Definition and scope of 2nd and 3rd transition metals, Electronic configuration and oxidation states, General physical and chemical properties, Classification of 2nd and 3rd transition metals Chemistry of Y, Zr, Nb, Mo, Tc, Ru, Rh, Pd, Ag, and Cd Chemistry of La, Ce, Pr, Nd, Pm, Sm, Eu, Gd, Tb, Dy, Ho, Er, Tm, Yb, Lu, Hf, Ta, W, Re, Os, Ir, Pt, Au
	Module-4	Introduction to Combination Compounds: Definition and classification of combination compounds Importance of combination compounds, Coordination Compounds: Introduction to coordination compounds, Coordination numbers and geometry, Ligands and coordination spheres, Isomerism in coordination compounds, Stability and reactivity of coordination compounds
	Module-5	**Lanthanides and Actinides :** Definition and classification of lanthanides and actinides, Electronic configuration of lanthanides and actinides **Chemistry of Lanthanides:** Physical and chemical properties of lanthanides, Separation and purification of lanthanides, Compounds of lanthanides (halides, oxides, etc.), Reactions of lanthanides (redox, complexation, etc.), Applications of lanthanides (catalysts, magnets, etc.), Biological importance of lanthanides, Advanced topics in lanthanide chemistry **Chemistry of Actinides**: Physical and chemical properties of actinides, Separation and purification of actinides, Compounds of actinides (halides, oxides, etc.), Reactions of actinides (redox, complexation, etc.), Applications of actinides (nuclear energy, etc.), Biological importance of actinides, Advanced topics in actinide chemistry

	Module-6	**Introduction to Oxidation and Reduction:** Definition, classification & Historical background of oxidation and reduction **Principles of Oxidation-Reduction Reactions:** Oxidation numbers and oxidation states, Electron transfer and oxidation-reduction reactions, Acid-base chemistry and oxidation-reduction reactions, Complexation and oxidation-reduction reactions **Mechanisms of Oxidation-Reduction Reactions:** Single-electron & Two-electron transfer mechanisms, Free radical mechanisms, Chain reactions and oxidation-reduction reactions, Catalysis and oxidation-reduction reactions, Biological mechanisms of oxidation-reduction reactions
	Suggested Recommended Books: 1. Physical Chemistry: An Introduction" by J. M. Seddon and J. D. Gale (Oxford University Press) 2. "Statistical Mechanics" by D. A. McQuarrie (University Science Books) 3. Physical Chemistry" by Peter W. Atkins (Oxford University Press) 4. "Physical Chemistry: A Molecular Approach" by D. A. McQuarrie and J. D. Simon (University Science Books) 5. "Physical Chemistry: Principles and Applications" by R. K. Yalamanchili (New Age International)	

Course Name- B.Sc. (PCM) - 2nd Year		
Course Code-[BPCM 209]		
Credits-6 (L-18 h/T-18h)		
	Course Outcomes (COs)	
	B.Sc. (PCM) - 2nd Year	
	BPCM 209: **Chemistry-II**	
	Students will be able to:	
	CO 1	Explain organic reaction mechanisms (substitution, elimination, addition)
	CO 2	Describe stereochemistry and its applications.
	CO 3	Understand organic synthesis (retrosynthesis, protecting groups).
	CO 4	Analyze spectroscopic methods (NMR, IR, MS).
	CO 5	Solve numerical problems involving organic chemistry
	Course Outline (CO)	
	1	**Unit-1/ Introduction /4 Hours Per Week**
	2	**Unit-2/** Ultraviolet Spectroscopy **/ 4 Hours Per Week**
	3	**Unit-3/ Alcohols / 5 Hours Per Week**

	4	**Unit-4/ Phenols / 5 Hours Per Week**
	5	**Unit-5/ Ethers Epoxides / 5 Hours Per Week**
	Detailed Syllabus	
	Module-1	Introduction to objective, scope and outcome of the course.
	Module-2	**Ultraviolet Spectroscopy:** Introduction to UV Spectroscopy, Principles of UV Spectroscopy, Electronic transitions and UV spectroscopy, Molecular orbitals and UV spectroscopy, Selection rules and UV spectroscopy, Instrumental methods in UV spectroscopy, Sample preparation and UV spectroscopy, Data analysis and UV spectroscopy, UV Spectral Analysis: Interpretation of UV spectra, Determination of molecular structure Determination of chemical bonding **Infrared spectroscopy**: Basic principles of IR spectroscopy, Instrumentation used in IR spectroscopy, Molecular vibrations and IR spectroscopy, IR active and inactive vibrations, Selection rules and IR spectroscopy, Instrumental methods in IR spectroscopy, Sample preparation and IR spectroscopy, Data analysis and IR spectroscopy
	Module-3	**Alcohols:** Properties and Reactions of Alcohols , Acid-base properties of alcohols, Oxidation reactions of alcohols, Reduction reactions of alcohols, Substitution reactions of alcohols, Elimination reactions of alcohols, Reaction mechanisms of alcohols **Synthesis and Characterization of Alcohols:** Synthesis of alcohols from alkyl halides, Synthesis of alcohols from alkenes, Synthesis of alcohols from carbonyl compounds, Characterization of alcohols using IR spectroscopy, Characterization of alcohols using NMR spectroscopy, Characterization of alcohols using mass spectrometry
	Module-4	**Phenols:** Acid-base properties of phenols, Oxidation reactions of phenols, Reduction reactions of phenols, Substitution reactions of phenols, Elimination reactions of phenols, Reaction mechanisms of phenols **Synthesis and Characterization of Phenols:** Synthesis of phenols from benzene, Synthesis of phenols from alkylbenzenes, Synthesis of phenols from carbonyl compounds, Characterization of phenols using IR spectroscopy, Characterization of phenols using NMR spectroscopy, Characterization of phenols using mass spectrometry

	Module-5	**Ethers Epoxides:** Definition and classification of ethers, Nomenclature of ethers, Physical and chemical properties of ethers **Properties and Reactions of Ethers:** Acid-base properties of ethers, Oxidation reactions of ethers, Reduction reactions of ethers, Substitution reactions of ethers, Elimination reactions of ethers, Reaction mechanisms of ethers **Epoxides:** Definition, classification & Nomenclature of epoxides**,** Physical and chemical properties of epoxides, Synthesis of epoxides, Reactions of epoxides, Synthesis of ethers and epoxides, Characterization of ethers and epoxides using IR spectroscopy, Characterization of ethers and epoxides using NMR spectroscopy, Characterization of ethers and epoxides using mass spectrometry
	Module-6	**Aldehydes and Ketones:** Definition and classification of aldehydes, Nomenclature of aldehydes Physical and chemical properties of aldehydes, Acid-base properties of aldehydes, Oxidation reactions of aldehydes, Reduction reactions of aldehydes, Substitution reactions of aldehydes, Elimination reactions of aldehydes, Reaction mechanisms of aldehydes Ketones: Definition and classification of ketones, Nomenclature of ketones, Physical and chemical properties of ketones, Synthesis of ketones, Reactions of ketones, Application of ketones in industry
	Module-7	**Aldehydes and Ketones:** Definition and classification of aldehydes, Nomenclature of aldehydes Physical and chemical properties of aldehydes, Acid-base properties of aldehydes, Oxidation reactions of aldehydes, Reduction reactions of aldehydes, Substitution reactions of aldehydes, Elimination reactions of aldehydes, Reaction mechanisms of aldehydes Ketones: Definition and classification of ketones, Nomenclature of ketones, Physical and chemical properties of ketones, Synthesis of ketones, Reactions of ketones, Application of ketones in industry **Synthesis and Characterization :** Synthesis of aldehydes and ketones, Characterization of aldehydes and ketones using IR spectroscopy, Characterization of aldehydes and ketones using NMR spectroscopy, Characterization of aldehydes and ketones using mass spectrometry
	Module-8	**Carboxylic Acids:** Definition, classification & Nomenclature of carboxylic acids, Physical and chemical properties of carboxylic acids Properties and Reactions of Carboxylic Acids: Acid-base properties of carboxylic acids, Oxidation reactions of carboxylic acids, Reduction reactions of carboxylic acids, Substitution reactions of carboxylic acids, Elimination reactions of carboxylic acids, Reaction mechanisms of carboxylic acids, Synthesis of carboxylic acids from alcohols, Synthesis of carboxylic acids from aldehydes and ketones Synthesis of carboxylic acids from alkyl halides

	Module-9	**Organic compound of nitrogen:** Definition and classification of organic compounds of nitrogen, Nomenclature of organic compounds of nitrogen, Physical and chemical properties of organic compounds of nitrogen, Acid-base properties of amines, Oxidation and reduction reactions of amines, Substitution and elimination reactions of amines, Reaction mechanisms of amines
	Suggested Recommended Books: 1. 1. Organic Chemistry" by Jerry March et al. (Wiley-Interscience) 2. "Organic Chemistry: An Introduction" by J. Clayden et al. (Oxford University Press) 3. "Advanced Organic Chemistry" by Francis A. Carey and Richard J. Sundberg (McGraw-Hill Education) 4Inorganic Chemistry" by James E. Huheey (HarperCollins Publishers) 5. "Inorganic Chemistry: Principles and Applications" by R. K. Yalamanchili (New Age International) 6. "Advanced Inorganic Chemistry" by Cotton and Wilkinson (Wiley-Interscience)	

Course Name- B.Sc. (PCM) - 2nd Year		
Course Code- BPCM 210		
Credits-6 (L-18 h/T-18h)		
	Course Outcomes (COs)	
	B.Sc. (PCM) - 2nd Year	
	BPCM 210: Chemistry - III	
	Students will be able to:	
	CO 1	Explain laws of thermodynamics (zeroth, first, second, third).
	CO 2	Describe chemical kinetics (rate laws, reaction mechanisms).
	CO 3	Understand quantum mechanics principles (wave-particle duality, uncertainty).
	CO 4	Analyze statistical mechanics principles (microcanonical, canonical).
	CO 5	Analyze and interpret experimental data related to physical chemistry.
	Course Outline (CO)	
	1	**Unit-1/** Introduction **/4 Hours Per Week**
	2	**Unit-2/ Thermodynamics I / 4 Hours Per Week**
	3	**Unit-3/ Thermodynamics II / 5 Hours Per Week**
	4	**Unit-4/ Phase Equilibrium / 5 Hours Per Week**
	5	**Unit-5/ Liquid Liquid Mixture / 5 Hours Per Week**
	Detailed Syllabus	

	Module-1	Introduction to objective, scope and outcome of the course.
	Module-2	**Thermodynamics I-** Definition and scope of thermodynamics, Thermodynamic systems and surroundings**,** Thermodynamic properties (temperature, pressure, volume)**,** Thermodynamic processes (isothermal, adiabatic, isobaric) **First Law of Thermodynamics**: Statement of the First Law, Concept of internal energy Relationship between heat, work, and internal energy, Mathematical formulation of the First Law, Energy transformations and conservation, Calculation of changes in internal energy. Heat transfer and work **Thermochemistry**: Definition and scope of thermochemistry, Laws of Thermochemistry, First Law of Thermochemistry (conservation of energy), Internal energy and enthalpy Hess's Law, Kirchhoff's equation, Applications of laws of thermochemistry **Thermochemical Calculations:** Standard enthalpy changes, Calculation of internal energy and enthalpy, Application of Hess's Law, Thermodynamic data analysis
	Module-3	**Thermodynamics II- Second Law of Thermodynamics:** Statement of the Second Law, Clausius inequality, Kelvin-Planck statement, Clausius-Clapeyron equation, Applications of the Second Law, Entropy changes for thermodynamic processes, Direction of spontaneous processes **Thermodynamic Cycles :** Carnot cycle, Rankine cycle, Otto cycle, Thermodynamic efficiency **Concept of Entropy:** Definition and units of entropy, Entropy change and heat transfer, Entropy change equations (Clausius, Gibbs), Isothermal, adiabatic, and isobaric processes Phase transitions and entropy, Entropy changes in thermodynamic cycles, Entropy and thermodynamic efficiency **Third Law of Thermodynamics:** Statement of the Third Law, Entropy at absolute zero Implications of the Third Law, Applications of the Third Law, Thermodynamic systems at low temperatures, Entropy changes at low temperatures **Chemical Equilibrium:** Equilibrium Constant & free energy, Thermodynamics derivation of law of mass action, Reaction isotherm & reaction isochore,

	Module-4	**Phase Equilibrium :** Definition and concept of phase equilibrium, Types of phase equilibrium, Phase rule, Statement of phase rule, Calculation of number of phases and components, Phase rule expressions, Phase rule in binary systems & ternary systems **Phase Equilibrium of Two-Component Systems:** Statement of phase rule for two-component systems, Calculation of number of phases and components, Phase rule expressions, Phase rule in binary systems, Phase rule in ideal and non-ideal solutions **Solid Solutions:** Definition and concept of solid solutions, Classification of solid solutions, Characteristics of solid solutions (lattice parameters, etc.), Effects of composition on solid solution properties, Solid solution microstructure & formation mechanisms, Thermodynamic principles governing solid solution formation, Influence of temperature and pressure on solid solution stability
	Module-5	**Liquid liquid Mixture:** Definition and concept of liquid-liquid mixtures, Types of liquid-liquid mixtures, Thermodynamic modeling of liquid-liquid mixtures, Liquid-liquid equilibrium data analysis, Liquid-liquid equilibrium data analysis, Liquid-liquid phase transitions, Equipment design for liquid-liquid extraction, Operating conditions for liquid-liquid extraction
	Suggested Recommended Books: 1. Physical Chemistry" by Peter W. Atkins (Oxford University Press) 2. "Physical Chemistry: A Molecular Approach" by D. A. McQuarrie and J. D. Simon (University Science Books) 3. "Physical Chemistry: Principles and Applications" by R. K. Yalamanchili (New Age International) 4. "Physical Chemistry: An Introduction" by J. M. Seddon and J. D. Gale (Oxford University Press) 5. "Statistical Mechanics" by D. A. McQuarrie (University Science Books)	

Course Name- B.Sc. (PCM) - 2nd Year	
Course Code-[BPCM 211]	
Credits-6 (L-18 h/T-18h)	
	Course Outcomes (COs)
	B.Sc. (PCM) - 2nd Year

	[BPCM 211]: **Math-I**	
	Students will be able to:	
	CO 1	Explain types of differential equations (ODEs, PDEs)
	CO 2	Describe solution methods for differential equations (separation of variables, integrating factors).
	CO 3	Understand vector calculus (gradient, divergence, curl).
	CO 4	Analyze vector-valued functions and their applications.
	CO 5	Analyze and interpret mathematical data.
	Course Outline (CO)	
	1	**Unit-1/ Introduction /4 Hours Per Week**
	2	**Unit-2/** Real Analysis **/ 4 Hours Per Week**
	3	**Unit-3/ Real sequences / 5 Hours Per Week**
	4	**Unit-4/** Properties of Derivable Functions **/ 5 Hours Per Week**
	5	**Unit-4/** Riemann's Integrations **/ 5 Hours Per Week**
	Detailed Syllabus	
	Module-1	Introduction to objective, scope and outcome of the course.
	Module-2	Real Analysis: Real number as a complete order of field, Limit point, Bolzano-Weierstrass therorem, Closed & open sets, Concepts of compactness & connectedness, Heine- Borel theorem, Holder inequality & Minkowski inequality, Metric space, Open & Close sets, Interior & closure of a set, Limit point of a set in Metric space
	Module-3	Real sequences: Limit & convergence of a sequence, Monotonic sequence, Cauchy's sequences, Subsequences, Cauchy's general principal of convergences, Properties of continuous functions on closed intervals
	Module-4	Properties of Derivable Functions: Darboux's & Rolle's theorem, notion of limit, Continuity & differentiability for functions of several variables, The directional derivatives. The total derivatives, Expression of total derivatives in terms of partial derivatives
	Module-5	Riemann's Integrations: Lower and upper Riemann integrals, Riemann inerrability, Mean value theorem of integral calculus, Fundamental theorem of integral calculus, Functions of bounded variations & total variations

	Suggested Recommended Books: 1. Algebra: A Graduate Course" by I. Martin Isaacs (AMS) 2. "Algebraic Structures" by William C. Waterhouse (Springer) 3. Differential Equations and Dynamical Systems" by Lawrence Perko (Springer) 4. "Differential Equations" by William E. Boyce and Richard C. DiPrima (Wiley-Interscience) 5. Vector Calculus" by Peter Baxandall (Cambridge University Press) 6. "Vector Calculus" by John H. Hubbard and Barbara Burke Hubbard (Prentice Hall) 7. "Calculus of Vector-Valued Functions" by John W. Helton (Springer)

Course Name- B.Sc. (PCM) - 2nd Year		
Course Code-[BPCM 212]		
Credits-6 (L-18 h/T-18h)		
	Course Outcomes (COs)	
	B.Sc. (PCM) - 2nd Year	
	[BPCM 212]: **Math-II**	
	Students will be able to:	
	CO 1	Explain real numbers and real sequences
	CO 2	Describe continuity, differentiability, and integrability.
	CO 3	Understand group theory and ring theory.
	CO 4	Analyze linear algebra and its applications.
	CO 5	Apply algebraic concepts to physics and engineering.
	Course Outline (CO)	
	1	**Unit-1/** Introduction **/4 Hours Per Week**
	2	**Unit-2/** Degree & order of Differential Equation **/ 4 Hours Per Week**
	3	**Unit-3/** First order but higher degree differential equations solvable for x, y & ϱ **/ 5 Hours Per Week**
	4	**Unit-4/** Homogenous differential linear equations **/ 5 Hours Per Week**
	5	**Unit-5/** Linear differential equations of 2nd order **/ 5 Hours Per Week**
	Detailed Syllabus	
	Module-1	Introduction to objective, scope and outcome of the course.

	Module-2	Degree & order of Differential Equation, Equation of 1st order & 1st Degree, Equations I which values are separable, Homogeneous equations & equations reducible to homogeneous form, Linear equations & equations reducible to linear form, Exact differential equation & equations which can be made exact
	Module-3	First order but higher degree differential equations solvable for x, y & ϱ, Clairaut's form & singular solutions with Extraneous Loci., Linear differential equations with constant coefficients, Complementary functions & particular Integrals
	Module-4	Homogenous differential linear equations, Simultaneous differential equations, Exact linear differential equations of nth order, Existence of uniqueness theorem
	Module-5	Linear differential equations of 2nd order , Linear Independence of solutions, Solution by transformation of the equation by changing the dependent variables, Factorization of operators, Method of variation of parameters, Method of undetermined coefficients
	Module-6	Partial differential equations of 1st order, Lagrange's linear equations, Charpit's general method of solutions, Homogenous & nonhomogeneous linear partial differential equations with constant coefficients, Equations reducible to equations with constant coefficients
	Suggested Recommended Books: 1. Differential Equations and Dynamical Systems" by Lawrence Perko (Springer) 2. "Differential Equations" by William E. Boyce and Richard C. DiPrima (Wiley-Interscience) 3. "Differential Equations: An Introduction" by A. C. King et al. (Cambridge University Press) 4.Calculus of Vector-Valued Functions" by John W. Helton (Springer) 5.Vector Calculus, Linear Algebra, and Differential Forms" by John H. Hubbard	

Course Name- B.Sc. (PCM) - 2nd Year
Course Code-[BPCM 213]
Credits-6 (L-18 h/T-18h)

	Course Outcomes (COs)	
	B.Sc. (PCM) - 2nd Year	
	[BPCM 213]: **Math-III**	
	Students will be able to:	
	CO 1	Explain numerical methods for solving algebraic and transcendental equations.
	CO 2	Describe numerical differentiation and integration.
	CO 3	Understand partial differential equations (PDEs) and their applications.
	CO 4	Analyze numerical solutions of ordinary differential equations (ODEs).
	CO 5	Analyze and interpret mathematical data.
	Course Outline (CO)	
	1	**Unit-1/ Introduction /4 Hours Per Week**
	2	**Unit-2/ Differences, Relation between Differences & Derivatives / 4 Hours Per Week**
	3	**Unit-3/ Central differences / 5 Hours Per Week**
	4	**Unit-4/ Relation between roots & coefficient of general polynomial / 5 Hours Per Week**
	5	**Unit-5/ Gauss elimination & iterative methods / 5 Hours Per Week**
	Detailed Syllabus	
	Module-1	Introduction to objective, scope and outcome of the course.
	Module-2	Differences, Relation between Differences & Derivatives, Differences of a polynomial, newton's formula for backward & forward interpolations, Divided differences, Lagrange's interpolations formula
	Module-3	Central differences, Gauss's sterling & Bessel's interpolation formula, numerical differentiation, Derivative from interpolation formula, numerical integrations, Derivations of general quadrature formula, Trapazoidal rules, Simpson's $1/3^{rd}$, $3/8^{th}$ & Gauss's quadrature formula
	Module-4	Relation between roots & coefficient of general polynomial equation in one variable, transformation of equations, Descarte's rule of signs, Solution of cubic equations by Cardon's methods, biquadratic methods Ferrari's methods Numerical solution of Algebraic & Transcendental equations, Bisection methods , Secant's methods, Regula falsi Methods, Iteration Methods, newton Rapson methods,
	Module-5	Gauss elimination & iterative methods, Partial pivoting methods, numerical solutions of ordinary differential equations of 1^{st} order with initial condition using Picard's, Euler & modified Euler methods

	Suggested Recommended Books: 1. Partial Differential Equations" by Lawrence C. Evans (American Mathematical Society) 2. "Partial Differential Equations: An Introduction" by Walter A. Strauss (Wiley-Interscience) 3. Partial Differential Equations" by Lawrence C. Evans (American Mathematical Society) 4. "Partial Differential Equations: An Introduction" by Walter A. Strauss (Wiley-Interscience) 5. "Measure Theory" by Donald L. Cohn (Birkhäuser) 6. "Measure and Integration" by Heinz König (Springer) 7. "Real and Complex Analysis" by Walter Rudin (McGraw-Hill)

UNIVERSITY OF TECHNOLOGY, JAIPUR

Syllabus
2nd Year B.Sc. (PCM) - July-2022)

Physics Lab [BPCM 252]

Credit 1 **Max. Marks: 100(IA: 60, ETE:40)**
0L+0T+2P

List of Experiments	
1	Study of dependence of velocity of wave propagation on line parameter using torsional wave apparatus
2	Study of variations of reflection coefficient of nature of termination using torsional wave apparatus
3.	Using platinum resistance thermometer find the melting point of the given substance
4.	To determine the dispersive power of prism
5.	To determine wave length of sodium light using grating
6.	To determine wave length of sodium light using Biprism
7.	To determine thermal conductivity of bad conductors
8.	Study of variation of total thermal radiation with temperature

UNIVERSITY OF TECHNOLOGY, JAIPUR

Syllabus
2nd Year B.Sc (PCM) - July-2022)

Chemistry Lab [BPCM 253]

Credit 1 **Max. Marks: 100(IA: 60, ETE:40)**
0L+0T+2P

List of Experiments	
1	Preparation of standard solution
2	Volumetric Analysis
3	Gravimetric Analysis
4	Thin layer chromatography
5	Separation of green leaf pigments
6	Separation of a mixture of dyes using cyclohexane & ethyl estate
7	Qualitative analysis- Identification of two organic compound through the functional group analysis

UNDERGRADUATE DEGREE COURSE

Bachelor of Science (PCM)

3rd Year

University of Technology

Vatika Road, Jaipur

Rajasthan 303903

B.Sc.(PCM) 3rd Year

Sr. No.	Subject Name	Subject Code	Subject Type	Credit Point	Tot. Max Marks	Int. Min Marks	Int. Max Marks	Ext. Min Marks	Ext. Max Marks	Teach Hours	Count Marks	Print Enable	Status	Update on New ERP
1	Physics - I	BPCM 305	Theoretical	3	50	0	0	18	50	3	Yes	Yes	Yes	Yes
2	Physics - II	BPCM 306	Theoretical	3	50	0	0	18	50	3	Yes	Yes	Yes	Yes
3	Physics - III	BPCM 307	Theoretical	3	50	0	0	18	50	3	Yes	Yes	Yes	Yes
4	Chemistry - I	BPCM 308	Theoretical	3	50	0	0	18	50	3	Yes	Yes	Yes	Yes
5	Chemistry - II	BPCM 309	Theoretical	3	50	0	0	18	50	3	Yes	Yes	Yes	Yes
6	Chemistry - III	BPCM 310	Theoretical	3	50	0	0	18	50	3	Yes	Yes	Yes	Yes
7	Maths - I	BPCM 311	Theoretical	4	75	0	0	27	75	4	Yes	Yes	Yes	Yes
8	Maths - II	BPCM 312	Theoretical	4	75	0	0	27	75	4	Yes	Yes	Yes	Yes
9	Maths - III	BPCM 313	Theoretical	4	75	0	0	27	75	4	Yes	Yes	Yes	Yes
10	Physics Lab	BPCM 352	Practical	2	75	0	0	27	75	4	Yes	Yes	Yes	Yes
11	Chemistry Lab	BPCM 353	Practical	2	75	0	0	27	75	4	Yes	Yes	Yes	Yes
				34	675	0	0	243	675	38				

L: Lecture, T: Tutorial, P: Practical, Cr: Credits
ETE: End Term Exam, IA: Internal Assessment

Course Name- Physics-I	
Course Code- BPCM 305	
Credits-3 (L-18 h/T-18h)	
Course Outcomes (COs)	
CO 1	Understand the fundamental principles of mechanics, electromagnetism and thermodynamics.
CO 2	Apply mathematical techniques to solve physics problems.
CO 3	Calculate and interpret experimental data.
CO 4	Analyze and interpret data using statistical methods.
CO 5	Develop problem-solving and critical thinking skills.
Course Outline (CO)	
1	Unit-1/ Reference systems /4 Hours Per Week
2	Unit-2/ Origin of the quantum theory / 4 Hours Per Week
3	Unit-3/ Quantum Mechanics / 5 Hours Per Week
4	Unit-4/ Structure of nuclei / 5 Hours Per Week
Detailed Syllabus	
Module-1	Reference systems: inertial frames, Galilean invariance propagation of light, Michelson Morley experiment, search for ether. Postulates for the special theory of relativity, Lorentz transformations, length contraction, time dilation, velocity addition, variation of mass with velocity, mass-energy equivalence, particle with zero rest mass.
Module-2	Origin of the quantum theory : Failure of classical physics to explain the phenomena such as black-body spectrum, photoelectric effect, Compton effect, Wave-particle duality, uncertainty principle, de Broglie's hypothesis for matter waves, the concept of Phase and group velocities, experimental demonstration of mater waves. Davisson and Germer's experiment. Consequence of de Broglie's concepts, Bohr’s complementary Principle, Bohr’s correspondence principle, Bohr’s atomic model, energies of a particle in a box, wave packets. Consequence of the uncertainty relation, gamma ray microscope, diffraction at a slit.
Module-3	Quantum Mechanics: Schrodinger's equation, Statistical interpretation of wave function, Orthogonality and normalization of wave function, Probability current density, Postulatory basis of quantum mechanics, operators, expectation values, Ehrenfest’s theorem, transition probabilities, applications to particle in a one and three dimensional boxes, harmonic oscillator in one dimension, reflection at a step potential, transmission across a potential barrier.

	Module-4	Spectra of hydrogen, deuteron and alkali atoms spectral terms, doublet fine structure, screening constants for alkali spectra for s, p, d and f states, selection rules. Discrete set of electronic energies of moleculers, quantisation of vibrational and rotational energies, determination of inter-nuclear distance, pure rotational and rotation vibration spectra. Dissociation limit for the ground and other electronic states, transition rules for pure vibration and electronic vibration spectra. Raman effect, Stokes and anti-Stokes lines, complimentary character of Raman and infrared spectra, experimental arrangements for Raman spectroscopy
	Module-5	Structure of nuclei:- Basic Properties of Nuclei: (1) Mass, (2) Radii, (3) Charge, (4) Angular Momentum, (5) Spin, (6) Magnetic Moment (μ), (7) Stability and (8) Binding Energy, Nuclear Models:- Liquid Drop Model, Mass formula, Shell Model, Types of Nuclear reactions, laws of conservation, Q-value of reactions, Interaction of Energetic particles with matter, Ionization chamber, GM Counter, Cloud Chambers, Fundamental Interactions, Classification of Elementary Particles, Particles and Antiparticles, Baryons, Hyperons, Leptons, and Mesons, Elementary Particle Quantum Numbers: Baryon Number, Lepton Number, Strangeness, Electric Charge, Hypercharge and Isospin, introductory idea of discovery of Higg's Boson.
	Recommended Books	
	1	- Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill. - A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1969, Indian Press. - Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications. - Thermodynamics, Kinetic theory & Statistical thermodynamics, F. W. Sears & G.L.Salinger. 1988, Narosa - University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

Course Name- Physics - II

Course Code- BPCM 306

Credits-3 (L-18 h/T-18h)

	Course Outcomes (COs)	
	CO 1	Understand the fundamental principles of mechanics, electromagnetism, and thermodynamics.
	CO 2	Apply mathematical techniques to solve physics problems.
	CO 3	Analyse and interpret experimental data.
	CO 4	Develop problem-solving and critical thinking skills.
	CO 5	

	Course Outline (CO)	
	1	Unit-1/ Amorphous and crystalline solids /4 Hours Per Week
	2	Unit-2/ Free electron model of a metal / 4 Hours Per Week
	3	Unit-3/ Intrinsic and extrinsic semiconductors / 5 Hours Per Week
	4	Unit-4/ Half and full wave rectifier / 5 Hours Per Week
	5	Unit-5/ Digital Circuits /Half and full wave rectifier / 5 Hours Per Week
	Detailed Syllabus	
	Module-1	**Amorphous and crystalline solids:** Elements of symmetry, seven crystal system, Cubic lattices, Crystal planes, Miller indices, Laue's equation for X-ray diffraction, Bragg's Law, Bonding in solids, classification. Cohesive energy of solid, Madelung constant, evaluation of Parameters, Specific heat of solids, classical theory (Dulong-Petit's law), Einstein and Debye theories, Vibrational modes of one dimensional monoatomic lattice, Dispersion relation, Brillouin Zone.
	Module-2	**Free electron model of a metal:** Solution of one dimensional Schrödinger equation in a constant potential, Density of states, Fermi Energy, Energy bands in a solid (KronigPenny model without mathematical details), Difference between Metals, Insulator and Semiconductors, Hall effect, Dia, Para and Ferromagnetism, Langevin's theory of dia and para-magnetism, Curie- Weiss's Law, Qualitative description of Ferromagnetism (Magnetic domains), B-H curve and Hysteresis loss.
	Module-3	**Intrinsic and extrinsic semiconductors**: Concept of Fermi level, Generation and recombination of electron hole pairs in semiconductors, Mobility of electrons and holes, drift and diffusion currents, p-n junction diode, depletion width and potential barrier, junction capacitance, I-V characteristics, Tunnel diode, Zener diode, Light emitting diode, solar cell, Bipolar transistors, pnp and npn transistors, characteristics of transistors, different configurations, current amplification factor, FET and MOSFET Characteristics.
	Module-4	**Half and full wave rectifier:** rectifier efficiency ripple factor, Bridge rectifier, Filters, Inductor filter, L and π section filters, Zener diode, regulated power supply using zener diode, Applications of transistors, Bipolar Transistor as amplifier, h-parameter, hparameter equivalent circuit, Transistor as power amplifier, Transistor as oscillator, principle of an oscillator and Bark Hausen's condition, requirements of an oscillator, Wein-Bridge oscillator and Hartley oscillator.
	Module-5	**Digital Circuits:** Difference between Analog and Digital Circuits, Binary Numbers, Decimal to Binary and Binary to Decimal Conversion, AND, OR and NOT Gates (Realization using Diodes and Transistor), NAND and NOR Gates as Universal Gates, XOR and XNOR Gate, De Morgan's Theorems, Boolean Laws, Simplification of Logic Circuit using Boolean Algebra, Digital to Analog Converter, Analog to Digital Converter.
	Reference Books	
	1	1. Introduction to solid state physics: C. Kittel.

		2. Solid State Physics: A.J. Dekkar. 3. Electronic Circuits: Mottershead. 4. Electronic Circuits: Millman and Halkias. 5. Semiconductor Devices: S.M. Sze. 6. Electronic devices: T.L. Floyd. 7. Device and Circuits: J. Millman and C. Halkias. 8. Electronic Fundamental and Applications: D. Chatopadhyay and P.C. Rakshit. 9. Electricity and Magnetism: K.K. Tiwari.

Course Name- Physics - III

Course Code- BPCM 307

Credits-3 (L-18 h/T-18h)

	Course Outcomes (COs)	
	CO 1	Understand advanced physics concepts, including quantum mechanics, electromagnetism, and condensed matter physics.
	CO 2	Apply mathematical techniques to solve complex physics problems.
	CO 3	Collect & formulate experimental data.
	CO 4	Analyze and interpret experimental data
	CO 5	Develop research skills and critical thinking.
	Course Outline (CO)	
	1	Unit-1/ Thermodynamic Description of system / 7 Hours Per Week
	2	Unit-2/ Thermodynamic Potentials / 6 Hours Per Week
	3	Unit-3/ Kinetic Theory of Gases / 6 Hours Per Week
	4	Unit-4/ Theory of Radiation / 7 Hours Per Week
	5	Unit-5/ Statistical Mechanics / 7 Hours Per Week
	Detailed Syllabus	
	Module-1	Thermodynamic Description of system: Zeroth Law of thermodynamics and temperature. First law and internal energy, conversion of heat into work, Various Thermodynamical Processes, Applications of First Law: General Relation between CP& CV, Work Done during Isothermal and Adiabatic Processes, Compressibility & Expansion Coefficient, Reversible & irreversible processes, Second law & Entropy, Carnot's cycle & theorem, Entropy changes in reversible & irreversible processes, Entropy-temperature diagrams, Third law of thermodynamics, Unattainability of absolute zero.

	Module-2	Thermodynamic Potentials: Enthalpy, Gibbs, Helmholtz and Internal Energy functions, Maxwell's relations & applications - Joule-Thompson Effect, ClausiusClapeyron Equation, Expression for (CP – CV), CP/CV, TdS equations. (
	Module-3	Kinetic Theory of Gases: Derivation of Maxwell's law of distribution of velocities and its experimental verification, Mean free path (Zeroth Order), Transport Phenomena: Viscosity, Conduction and Diffusion (for vertical case), Law of equipartition of energy (no derivation) and its applications to specific heat of gases; mono-atomic and diatomic gases.
	Module-4	Theory of Radiation: Blackbody radiation, Spectral distribution, Concept of Energy Density, Derivation of Planck's law, Deduction of Wien's distribution law, RayleighJeans Law, Stefan Boltzmann Law and Wien's displacement law from Planck's law
	Module-5	Statistical Mechanics: Maxwell-Boltzmann law - distribution of velocity - Quantum statistics - Phase space - Fermi-Dirac distribution law - electron gas - Bose-Einstein distribution law - photon gas - comparison of three statistics.
	Recommended Books	
	1	-Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill. - A Treatise on Heat, Meghnad Saha, and B.N. Srivastava, 1969, Indian Press. - Thermodynamics, Enrico Fermi, 1956, Courier Dover Publications. - Thermodynamics, Kinetic theory & Statistical thermodynamics, F.W.Sears & G.L.Salinger. 1988, Narosa - University Physics, Ronald Lane Reese, 2003, Thomson Brooks/Cole.

Course Name- Chemistry - I

Course Code- BPCM 308

Credits-3 (L-18 h/T-18h)

	Course Outcomes (COs)	
	CO 1	Describe **Metal-ligand bonding in transition metal complexes**
	CO 2	Describe **Magnetic properties of transition metal complexes**
	CO 3	Explain **Organometallic Chemistry**
	CO 4	Describe **Bioinorganic chemistry**
	CO 5	Explain **Bioinorganic chemistry**
	Course Outline (CO)	
	1	Unit-1/ **Metal-ligand bonding in transition metal complexes** /7 Hours Per Week

	2	Unit-2/ **Magnetic properties of transition metal complexes** / 6 Hours Per Week
	3	Unit-3/ **Organometallic Chemistry** / 6 Hours Per Week
	4	Unit-4/ **Bioinorganic chemistry** / 7 Hours Per Week
	5	Unit-5/ **Bioinorganic chemistry** / 6 Hours Per Week
	Detailed Syllabus	
	Module-1	**Metal-ligand bonding in transition metal complexes:** (A) Limitations of valence bond theory, Limitation of Crystal Field Theory, Application of CFSE, tetragonal distortions from octahedral geometry, Jahn–Teller distortion, square planar geometry. Qualitative aspect of Ligand field and MO Theory. (B) Thermodynamic and kinetic aspects of metal complexes. A brief outline of thermodynamic stability of metal complexes and factors affecting the stability, substitution reactions of square planar complexes, Trans- effect, theories of trans effect. Mechanism of substitution reactions of square planar complexes.
	Module-2	**Magnetic properties of transition metal complexes:** Types of magnetic behavior, methods of determining magnetic susceptibility, spin only formula, L-S coupling, correlation of μso (spin only) and μeff. values, orbital contribution to magnetic moments, application of magnetic moment data for 3d metal complexes. Electronic spectra of Transition Metal Complexes. Types of electronic transitions, selection rules for d-d transitions, spectroscopic ground states, spectro-chemical series. Orgel-energy level diagram for d1 and d2 states, discussion of the electronic spectrum of [Ti(H2O)6] 3+ complex ion.
	Module-3	**Organometallic Chemistry:** Definition and classification of organometallic compounds on the basis of bond type. Concept of hapticity of organic ligands. Metal carbonyls: 18-electron rule, electron count of mononuclear, polynuclear and substituted metal carbonyls of 3d series. General methods of preparation (direct combination, reductive carbonylation, thermal and photochemical decomposition) of mono and binuclear carbonyls of 3d series. Structures of mononuclear and binuclear carbonyls of Cr, Mn, Fe, Co and Ni using VBT. πacceptor behavior of CO (MO diagram of CO to be discussed), Zeise's salt: Preparation and structure
	Module-4	**Bioinorganic chemistry**: Essential and trace elements in biological processes, Excess and deficiency of some trace metals, Toxicity of some metal ions (Hg, Pb, Cd and As), metalloporphyrins with special reference to hemoglobin and myoglobin. Biological role of alkali and alkaline earth metals with special reference to Ca2+ and Mg2+ , nitrogen fixation.
	Module-5	**Hard and soft acids and bases** (HSAB): Classification of acids and bases as hard and soft. Pearson's HSAB concept, acid-base strength and hardness and softness. Symbiosis, Applications of HSAB principle. INORGANIC POLYMERS Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones. Silicates, phosphazenes and polyphosphate.
	Reference Books	
	1	Basic Inorganic Chemistry, F. A. Cotton, G. Wilkinson and P. L. Gaus, Wiley. 2. Concise Inorganic Chemistry, J. D. Lee, ELBS. 3. Concepts of Models of Inorganic Chemistry, B. Douglas, D. Mc Daniel and J. Alexander, John Wiley. 4. Inorganic Chemistry, D. E. Shriver, P. W. Atkins and C. H. Langford, Oxford. 5. Inorganic Chemistry, W. W. Porterfield,

		Addison – Wiley. 6. Inorganic Chemistry, A. G. Sharp, ELBS. 7. Inorganic Chemistry, G. L. Miessler and D. A. Tarr, Prentice Hall. 8. Advanced Inorganic Chemistry, Satya Prakash.

Course Name- Chemistry - II

Course Code- BPCM 309

Credits-3 (L-18 h/T-18h)

	Course Outcomes (COs)	
	CO 1	Discuss about HETEROCYCLIC COMPOUNDS
	CO 2	Describe substitution, elimination, and addition reactions
	CO 3	Explain stereochemistry and regioselectivity
	CO 4	Analyze SYNTHETIC POLYMERS
	CO 5	Explain SPECTROSCOPY
	Course Outline (CO)	
	1	Unit-1/ HETEROCYCLIC COMPOUNDS /6 Hours Per Week
	2	Unit-2/ ORGANOMETALLIC REAGENT / 6 Hours Per Week
	3	Unit-3/ BIOMOLECULES / 5 Hours Per Week
	4	Unit-4/ SYNTHETIC POLYMERS / 6 Hours Per Week
	5	Unit-5/ SPECTROSCOPY / 6 Hours Per Week
	Detailed Syllabus	
	Module-1	HETEROCYCLIC COMPOUNDS: Classification and nomenclature, Structure, aromaticity in 5-membered and 6-membered rings containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of: Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis), Indole (Fischer indole synthesis and Madelung synthesis), Quinoline and isoquinoline, (Skraup synthesis, Friedlander's synthesis, Knorr quinoline synthesis, Doebner- Miller synthesis, Bischler-Napieralski reaction, Pictet- Spengler reaction, Pomeranz-Fritsch reaction).
	Module-2	ORGANOMETALLIC REAGENT Organomagnesium compounds: Grignard reagents formation, structure and chemical reactions. Organozinc compounds: formation and chemical reactions. Organolithium compounds: formation and chemical reactions. B. ORGANIC SYNTHESIS VIA ENOLATES Active methylene group, alkylation of diethylmalonate and ethyl acetoacetate, Synthesis of ethyl acetoacetate: The Claisen condensation. Keto-enol tautomerism of ethyl acetoacetate. Robbinson annulations reaction.

	Module-3	BIOMOLECULES A. CARBOHYDRATES Occurrence, classification and their biological importance. Monosaccharides: relative and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses; Killiani Fischer synthesis and Ruff degradation; Disaccharides – Structural comparison of maltose, lactose and sucrose. Polysaccharides – Elementary treatment of starch and cellulose. B. AMINO ACIDS, PROTEINS AND NUCLEIC ACIDS Classification and Nomenclature of amino acids, Configuration and acid base properties of amino acids, Isoelectric Point, Peptide bonds, Protein structure, denaturation/ renaturation, Constituents of nucleic acid, DNA, RNA nucleoside, nucleotides, double helical structure of DNA.
	Module-4	**SYNTHETIC POLYMERS** A. Addition or chain growth polymerization, Free radical vinyl polymerization, Ziegler-Natta polymerization, Condensation or Step growth polymerization, polyesters, polyamides, phenols- formaldehyde resins, urea-formaldehyde resins, epoxy resins and polyurethanes, natural and synthetic rubbers. B. SYNTHETIC DYES Colour and constitution (Electronic Concept). Classification of Dyes. Chemistry of dyes. Chemistry and synthesis of Methyl Orange, Congo Red, Malachite Green, Crystal Violet, phenolphthalein, fluorescein, Alizarine and Indigo.
	Module-5	A. INFRA-RED SPECTROSCOPY Basic principle, IR absorption Band their position and intensity, IR spectra of organic compounds. B. UV-VISIBLE SPECTROSCOPY Beer Lambert's law, effect of Conjugation, Types of electronic transitions λmax, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption Visible spectrum and colour. C. NMR SPECTROSCOPY Basic principles of Proton Magnetic Resonance, Tetramethyl silane (TMS) as internal standard, chemical shift and factors influencing it; Spin – Spin coupling and coupling constant (J); Anisotropic effects in alkene, alkyne, aldehydes and aromatics, Interpretation of NMR spectra of simple organic compounds. 13CMR spectroscopy: Principle and applications.
	Recommended Books	
		1. Organic Chemistry, Morrison and Boyd, Prentice-Hall. 2. Organic Chemistry, L. G. Wade Jr. Prentice Hall. 3. Fundamentals of Organic Chemistry, Solomons, John Wiley. 4. Organic Chemistry, Vol I, II, III S. M. Mukherjee, S. P. Singh and R. P. Kapoor, Wiley Easters (New Age). 5. Organic Chemistry, F. A. Carey, McGraw Hill. 6. Introduction to Organic Chemistry, Struiweisser, Heathcock and Kosover, Macmillan. 7. Acheson, R.M. Introduction to the Chemistry of Heterocyclic compounds, John Wiley & Sons (1976).

Course Name- Chemistry - III

Course Code- BPCM 310

Credits-3 (L-18 h/T-18h)

	Course Outcomes (COs)	
	CO 1	Describe retrosynthetic analysis and planning
	CO 2	Explain functional group transformations and protection
	CO 3	Analyze yield and purification methods
	CO 4	Computational Analysis of ELECTROCHEMISTRY-I
	CO 5	Computational Analysis of ELECTROCHEMISTRY-II
	Course Outline (CO)	
	1	Unit-1/ QUANTUM MECHANICS–I /4 Hours Per Week
	2	Unit-2/ QUANTUM MECHANICS–II / 4 Hours Per Week
	3	Unit-3/ SPECTROSCOPY / 5 Hours Per Week
	4	Unit-4/ ELECTROCHEMISTRY-I / 5 Hours Per Week
	5	Unit-5/ ELECTROCHEMISTRY-II / 5 Hours Per Week
	Detailed Syllabus	
	Module-1	QUANTUM MECHANICS–I Black-body radiation, Planck's radiation law, photoelectric effect, Compton effect. Operator: Hamiltonian operator, angular momentum operator, Laplacian operator, postulate of quantum mechanics, eigen values, eigen function, Schrodinger time independent wave equation, physical significance of ψ & ψ 2 , application of Schrodinger wave equation to particle in a one dimensional box, hydrogen atom (separation into three equations) radial and angular wave functions.
	Module-2	QUANTUM MECHANICS–II Quantum Mechanical approach of Molecular orbital theory, basic ideas-criteria for forming M.O. and A.O., LCAO approximation, formation of H2 + ion, calculation of energy levels from wave functions, bonding and antibonding wave functions, Concept of σ, σ^*, π, π^* orbitals and their characteristics, Hybrid orbitals-sp,sp2 ,sp3 Calculation of coefficients of A.O.'s used in these hybrid orbitals. Introduction to valence bond model of H2, comparison of M.O. and V.B. models. Huckel theory, application of Huckel theory to ethene, propene, etc.
	Module-3	SPECTROSCOPY Introduction: Characterization of Electromagnetic radiation, regions of the spectrum, representation of spectra, width and intensity of spectral transition, Rotational Spectrum of Diatomic molecules. Energy levels of a rigid rotor, selection rules, determination of bond length, qualitative description of non-rigid rotator, isotopic effect.

		Vibrational Spectroscopy: Fundamental vibration and their symmetry vibrating diatomic molecules, Energy levels of simple harmonic oscillator, selection rules, pure vibrational spectrum, determination of force constant, anharmonic oscillator Raman spectrum: Concept of polarizability, quantum theory of Raman spectra, stokes and antistokes lines, pure rotational and pure vibrational Raman spectra. Applications of Raman Spectra. Electronic Spectroscopy: Basic principles, Electronic Spectra of diatomic molecule, Franck-Condon principle, types of electronic transition, application of electronic spectra
	Module-4	ELECTROCHEMISTRY-I A. Electrolytic conductance: Specific and equivalent conductance, measurement of equivalent conductance, effect of dilution on conductance, Kohlrausch law, application of Kohlrausch law in determination of dissociation constant of weak electrolyte, solubility of sparingly soluble electrolyte, absolute velocity of ions, ionic product of water, conductometric titrations. B. Theories of strong electrolyte: limitations of Ostwald's dilution law, weak and strong electrolytes, Elementary ideas of Debye – Huckel - Onsager's equation for strong electrolytes , relaxation and electrophoretic effects. C. Migration of ions: Transport number, Determination by Hittorf method and moving boundary method, ionic strength.
	Module-5	ELECTROCHEMISTRY-II A. Electrochemical cell and Galvanic cells – reversible and irreversible cells, conventional representation of electrochemical cells, EMF of the cell and effect of temperature on EMF of the cell, Nernst equation Calculation of ΔG, ΔH and ΔS for cell reactions. B. Single electrode potential : standard hydrogen electrode, calomel electrode, quinhydrone electrode, redox electrodes, electrochemical series C. Concentration cell with and without transport, liquid - junction potential, application of concentration cells in determining of valency of ions , solubility product and activity coefficient D. Corrosion-types , theories and prevention
	Reference Books	
	1	Physical chemistry, G.M.Barrow. International Student Edition McGraw Hill.
	2	University General Chemistry, CNR Rao, Macmillan.
	3	Physical Chemistry R.A.Alberty, Wiley Eastrn.
	4	The elements of Physical Chemistry P.W.Alkin,Oxford.
	5	Physical Chemistry through problems, S.K.Dogra, Wiley Eastern.
	6	Physical Chemistry B.D.Khosla.
	7	Physical Chemistry, Puri & Sharma

Course Name- Maths - I

Course Code- BPCM 311

Credits-3 (L-18 h/T-18h)

	Course Outcomes (COs)

CO 1	Describe metric spaces
CO 2	Explain Dense subsets
CO 3	Calculate Complex numbers as ordered pairs
CO 4	Calculate Series of arbitrary terms
CO 5	Calculate Riemann integral

Course Outline (CO)

1	Unit-1/ Definition and examples of metric spaces /5 Hours Per Week
2	Unit-2/ Dense subsets / 6 Hours Per Week
3	Unit-3/ Complex numbers as ordered pairs / 7 Hours Per Week
4	Unit-4/ Series of arbitrary terms / 7 Hours Per Week
5	Unit-5/ Riemann integral/6 Hours Per Week

Detailed Syllabus

Module-1	Definition and examples of metric spaces. Neighbourhoods, Limit points, Interior points, Open and Closed sets, Closure and interior. Boundary points, Sub-space of a metric space. Cauchy sequences, Completeness, Cantor's intersection theorem. Contraction principle, construction of real numbers as the completion of the incomplete metric space of rationals. Real numbers as a complete ordered field.
Module-2	Dense subsets. Baire Category theorem. Separable, second countable and first countable spaces. Continuous functions. Extension theorem. Uniform continuity, isometry and homeomorphism. Equivalent metrics. Compactness, sequential compactness. Totally bounded spaces. Finite intersection property. Continuous functions and Compact sets, Connectedness, Components, Continuous functions and Connected sets.
Module-3	Complex numbers as ordered pairs; Geometrical representation of complex numbers. Stereographic projection. Continuity and differentiability of complex functions. Analytic functions. Cauchy Riemann equations. Harmonic functions. Elementary functions. Mapping by elementary functions. Mobius transformations. Fixed points, Cross ratio. Inverse points and critical mappings. Conformal mappings.
Module-4	Series of arbitrary terms: Convergence, divergence and oscillation. Abel's and Dirichlet's test. Multiplication of series. Double series. Partial derivation and differentiability of real-valued functions of two variables. Schwarz and Young's theorem. Implicit function theorem. Fourier series. Fourier expansion of piecewise monotonic functions.
Module-5	Riemann integral: Intergrability of continuous and monotonic functions. The fundamental theorem of integral calculus. Mean value theorems of integral calculus. Improper integrals and their convergence. Comparison tests. Abel's and Dirichlet' tests. Frullani's integral. Integral as a function of a parameter. Continuity, derivability and integrability of an integral of a function of a parameter.

Reference Books

	1	T.M. Apostol, Mathematical Analysis, Narosa Publishing House, New Delhi, 1985.
	2	R.R. Goldberg, Real Analysis, Oxford & IBH publishing Co., New Delhi, 1970.
	3	S. Lang, Undergraduate Analysis, Springer-Verlag, New York, 1983.
	4	D. Somasundaram and B. Choudhary, A First Coarse in Mathematical Analysis, Narosa Publishing House,

Course Name- Maths - II

Course Code- BPCM 312

Credits-3 (L-18 h/T-18h)

	Course Outcomes (COs)	
	CO 1	Describe Group- Automorphisms
	CO 2	Explain Ring theory-Ring homomorphism
	CO 3	Analyze vector spaces
	CO 4	Linear transformations and their representation as matrices
	CO 5	Inner Product Spaces-Cauchy-Schwarz inequality
	Course Outline (CO)	
	1	Unit-1/ Group- Automorphisms /4 Hours Per Week
	2	Unit-2/ Ring theory-Ring homomorphism / 4 Hours Per Week
	3	Unit-3/ Definition and examples of vector spaces / 5 Hours Per Week
	4	Unit-4/ Linear transformations and their representation as matrices / 5 Hours Per Week
	Detailed Syllabus	
	Module-1	Group- Automorphisms: inner automorphism. Automorphism of groups and their computations, Conjugacy relation, Normaliser, Counting principle and the class equation of a finite group. Center for Group of prime-order, Abelianizing of a group and its universal property. Sylow's theorems, Sylow subgroup, Structure theorem for finite Abelian groups
	Module-2	Ring theory-Ring homomorphism: Ideals and quotient rings. Field of quotients of an integral domain, Euclidean rings, polynomial rings, Polynomials over the rational field. The Eisenstien criterion, polynomial rings over commutative rings, Unique factorization domain. R unique factorisation domain implies so is R[x1, x2 ..... xn]. Modules, Submodules, Quotient modules, Homomorphism and Isomorphism theorems.
	Module-3	Definition and examples of vector spaces: Subspaces. Sum and direct sum of subspaces. Linear span, Linear dependence, independence and their basic properties. Basis. Finite dimensional vector spaces. Existence theorem for bases. Invariance of the number of

		elements of a basis set. Dimension. Existence of complementary subspace of a finite dimensional vector space. Dimension of sums of subspaces. Quotient space and its dimension.
	Module-4	Linear transformations and their representation as matrices: The Algebra of linear transformations. The rank nullity theorem. Change of basis. Dual space. Bidual space and natural isomorphism. Adjoint of a linear transformation. Eigenvalues and eigenvectors of a linear transformation. Diagonalisation. Annihilator of a subspace. Bilinear, Quadratic and Hermitian forms.
	Module-5	Inner Product Spaces-Cauchy-Schwarz inequality: Orthogonal vectors. Orthogonal Complements. Orthonormal sets and bases. Bessel's inequality for finite dimensional spaces. Gram-Schmidt Orthogonalization process.
	Reference Books	
	1	I.N. Herstein, Topics in Algebra, Wiley Eastern Ltd., New Delhi, 1975.
	2	N. Jacobson, Basic Algebra, Vols. I & II. W.H. Freeman, 1980 (also published by Hindustan Publishing Company).
	3	Shanti Narayan, A Text Book of Modern Abstract Algebra, S.Chand & Co. New Delhi.
	4	S.K. Jain, A. Gunawardena and P.B. Bhattacharya, Basic Linear Algebra with MATLAB. Key College Publishing (Springer-Verlag) 2001.
	5	K.B. Datta, Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi, 2000

Course Name- Maths - III

Course Code- BPCM 313

Credits-3 (L-18 h/T-18h)

	Course Outcomes (COs)	
	CO 1	Calculate Sets and Propositions
	CO 2	Calculate Relations and Functions
	CO 3	Described Finite State Machines
	CO 4	Elaborate Recurrence Relations and Recursive Algorithms
	CO 5	Calculate Boolean Algebras
	Course Outline (CO)	
	1	Unit-1/ Sets and Propositions /4 Hours Per Week
	2	Unit-2/ Relations and Functions / 4 Hours Per Week
	3	Unit-3/ Finite State Machines / 5 Hours Per Week

	4	Unit-4/ Recurrence Relations and Recursive Algorithms / 5 Hours Per Week
	5	Unit-5/ Boolean Algebras / 5 Hours Per Week
	Detailed Syllabus	
	Module-1	Sets and Propositions - Cardinality. Mathematical Induction, Principle of inclusion and exclusion. Computability and Formal Languages - Ordered Sets. Languages. Phrase Structure Grammars. Types of Grammars and Languages. Permutations. Combinations and Discrete Probability.
	Module-2	Relations and Functions - Binary Relations, Equivalence Relations and Partitions. Partial Order Relations and Lattices. Chains and Antichains. Pigeon Hole Principle. Graphs and Planar Graphs - Basic Terminology. Multigraphs. Weighted Graphs. Paths and Circuits. Shortest Paths. Eulerian Paths and Circuits. Travelling Salesman Problem. Planner Graphs. Trees.
	Module-3	Finite State Machines - Equivalent Machines. Finite State Machines as Language Recognizers. Analysis of Algorithms - Time Complexity. Complexity of Problems. Discrete Numeric Functions and Generating Functions.
	Module-4	Recurrence Relations and Recursive Algorithms - Linear Recurrence Relations with constant coefficients. Homogeneous Solutions. Particular Solution. Total Solution. Solution by the Method of Generating Functions. Brief review of Groups and Rings
	Module-5	Boolean Algebras - Lattices and Algebraic Structures. Duality, Distributive and Complemented Lattices. Boolean Lattices and Boolean Algebras. Boolean Functions and Expressions. Prepositional Calculus. Design and Implementation of Digital Networks. Switching Circuits.
	Recommended Books	
	1	C.L. Liu, Elements of Discrete Mathematics, (Second Edition), McGraw Hill, International Edition, Computer Science Series, 1986

UNIVERSITY OF TECHNOLOGY, JAIPUR

Syllabus
3rd Year B.Sc (PCM) - July-2022)

Physics Lab [BPCM 352]

Credit 1 **Max. Marks: 100(IA:60, ETE:40)**
0L+0T+2P

1. Determine the planks constant by photo cell
2. Determine the planks constant by solar cell
3. Determine the Stefan Boltzmann constant
4. Study of the temperature dependence of the resistance
5. Study of the iodine separation with the help of grating
6. Study of absorption in Al foil using GM counter
7. e/m measurement by helical method
8. Measurement of electric charge by Millikan's oil drop method
9. To find the magnetic susceptibility of a paramagnetic solution using Quick's method

UNIVERSITY OF TECHNOLOGY, JAIPUR

Syllabus
3rd Year B.Sc (PCM) - July-2022)

Chemistry Lab [BPCM 353]

Credit 1 **Max. Marks: 100 (IA:60, ETE:40)**
0L+0T+2P

Inorganic Chemistry

1. Synthesis & Analysis of
   (a) Potassium Trioxalatoferate (III), $K_3[Fe(C_2O_4)_3]$
   (b) Sulphate $[Cu(NH_3)_4]SO_4$

2. Instrumentation
   Calorimeter
   (a) Job's
   (b) Mole ratio's Method
   Adulteration Food Stuff
   Effluent water analysis
3. Solvent Extraction
   Separation & Extraction of Mg (II) & Fe (II)
   Ion Exchange Method
   Separation & Extraction of Mg (II) & Fe (II)

Organic Chemistry

1. Steam Distillation- naphthalene from its suspension of water
2. Clove oil from clove
3. Separation of o & p nitro phenol
4. Resolution of racemic mixture of (+) mendelic acid

Physical Chemistry

1. To determine the ionization constant of weak acid coductometrically
2. To study the saponification of ethyl acetate coductometrically
3. To study the strength of the give acid coductometrically using standard alkali solution