

UNDERGRADUATE DEGREE COURSE

Bachelor of Science (PCM)

July 23



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	Attain an 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 (Scheme Updated in Session July-2023)

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

E TE: 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	
Scheme Updated on Session - July-2019, July-2020, July-2021, July-2022, July-2023	
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 (patralekhan)
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	
	<ol style="list-style-type: none"> 1. "Hindi VyakaranaurRachna" by Dr. S. C. Gupta (Publication: Lakshya Publication) 2. "Hindi SahityakaItihas" by Dr.RamchandraShukla (Publication: Hindi SahityaSadan) 3. "Hindi Nibandh" by Dr. O. P. Singh (Publication: KitabMahal) 4. Hindi Vyakaran" by Dr. S. K. Mishra (Publication: BharatiBhawan) 5. "Hindi Rachna" by Dr. L. N. Sharma (Publication: Lakshya Publication) 6. "Hindi SahityakaSwaroop" by Dr. R. C. Sharma (Publication: Hindi SahityaSadan)

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	
Scheme Updated on Session - July-2019, July-2020, July-2021, July-2022, July-2023	
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 (KitabMahal)
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

Scheme Updated on Session - July-2019, July-2020, July-2021, July-2022, July-2023

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 ErachBharucha (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

Scheme Updated on Session - July-2019, July-2020, July-2021, July-2022, July-2023

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,scopeandoutcomeofthecourse.
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

Scheme Updated on Session - July-2019, July-2020, July-2021, July-2022, July-2023

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,scopeandoutcomeofthecourse.

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 (BharatiBhawan)
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

Scheme Updated on Session - July-2019, July-2020, July-2021, July-2022, July-2023

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 (BharatiBhawan)
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

Scheme Updated on Session - July-2019, July-2020, July-2021, July-2022, July-2023

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 (BharatiBhawan)
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

Scheme Updated on Session - July-2019, July-2020, July-2021, July-2022, July-2023

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 , ClF_3 , ICl_2 , H_2O Molecular Orbital theory: homonuclear & heteronuclear (CO & NO) diatomic 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 & complexation 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), tetrasulphur, 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

Scheme Updated on Session - July-2019, July-2020, July-2021, July-2022, July-2023

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 & Heterolytic bonds, Cleavage type of reagents, 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, stereogenic centers, Optical activities, Properties of enantiomers, chiral & achiral molecules with two stereogenic centers, Diastereomers, Resolution of enantiomers, Inversion, retention & racemization, Z system of nomenclature, Geometric Isomerism in oximes & alicyclic compounds Conformational Isomerism: Newman Projection & Sawhorse Formulae, Conformational 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 strain in rings Alkenes, Cycloalkenes, Dienes & Alkynes: Methods of Formation, mechanism of dehydration of alcohols & dehydrohalogenation of alkyl halides, Regioselectivity of Alcohol dehydration- the Saytzeff rule, Hoffmann 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

Scheme Updated on Session - July-2019, July-2020, July-2021, July-2022, July-2023

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 , $\sin x$ & $\log x$, 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	<p>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</p> <p>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</p>
Module-4	<p>Solid States: Introduction to Solids, classification of solids, Crystal structures and unit cells, Lattice parameters and crystal systems</p> <p>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</p> <p>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</p>
Module-5	<p>Colloidal States: Introduction, Definition and importance of colloids, Types of colloids (lyophobic, lyophilic), Preparation methods (condensation, dispersion)</p> <p>Properties of Colloids: Brownian motion and sedimentation, Electrokinetic phenomena (electrophoresis, electroosmosis), Interfacial tension and surface energy, Viscosity and rheology of colloids</p>

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

Scheme Updated on Session - July-2019, July-2020, July-2021, July-2022, July-2023

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 remainder 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	
	<ol style="list-style-type: none"> 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	
Scheme Updated on Session - July-2019, July-2020, July-2021, July-2022, July-2023	
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	Analyse 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 $\sin x$, $\cos x$, 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

	<ol style="list-style-type: none"> 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
Scheme Updated on Session - July-2019, July-2020, July-2021, July-2022, July-2023

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, Chebyshev'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

	<ol style="list-style-type: none"> 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)

ComputerLab [BPCM 151]

Credit1
0L+0T+2P

Max.Marks:100(IA: 60,ETE:40)

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

PhysicsLab [BPCM 152]

Credit1
0L+0T+2P

Max.Marks:100(IA: 60,ETE:40)

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]

Credit1
0L+0T+2P

Max.Marks:100(IA: 60,ETE:40)

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 ₂ SO ₄ by studying the kinetics of hydrolysis of ethyl acetate
6	To study kinetically the reaction rate of decomposition of iodide by H ₂ O 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 low 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 1 st law of thermodynamics, Infinitesimal general interaction, Gibb's free energy, Phase transition, Clausius clapeyron 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 low 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
<p>Suggested Recommended Books:</p> <ol style="list-style-type: none"> 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 causality, 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:	
<ol style="list-style-type: none"> 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	<p>Circuit Analysis: Introduction to circuit analysis, Kirchhoff's laws, Nodal and mesh analysis</p> <p>Thevenin and Norton equivalents, Superposition theorem, Maximum power transfer theorem, AC circuit analysis, Phasors and impedance, AC circuit theorems, Applications of circuit analysis</p> <p>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.)</p>
Module-3	<p>Rectifier Circuits : Introduction to rectifiers, Half-wave and full-wave rectifiers, Bridge rectifiers</p> <p>Rectifier efficiency and ripple factor, Filter circuits (RC, RL, RLC), Rectifier applications (power supplies, motor control), Rectifier protection circuits</p>
Module-4	<p>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</p>
Module-5	<p>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</p> <p>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)</p>

	<p>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</p> <p>Module-6 Logic Circuits :Number systems (binary, decimal, hexadecimal), Logic gates (AND, OR, NOT)</p> <p>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)</p>
<p>Suggested Recommended Books:</p> <ol style="list-style-type: none"> 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	<p>Definition and scope of transition metals, Electronic configuration and oxidation states, General physical and chemical properties, Classification of transition metals</p> <p>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</p> <p>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</p>
	Module-3	<p>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</p> <p>Chemistry of Y, Zr, Nb, Mo, Tc, Ru, Rh, Pd, Ag, and Cd</p> <p>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</p>
	Module-4	<p>Introduction to Combination Compounds: Definition and classification of combination compounds</p> <p>Importance of combination compounds,</p> <p>Coordination Compounds: Introduction to coordination compounds, Coordination numbers and geometry, Ligands and coordination spheres, Isomerism in coordination compounds, Stability and reactivity of coordination compounds</p>
	Module-5	<p>Lanthanides and Actinides : Definition and classification of lanthanides and actinides, Electronic configuration of lanthanides and actinides</p> <p>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</p> <p>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</p>

Module-6	<p>Introduction to Oxidation and Reduction: Definition, classification & Historical background of oxidation and reduction</p> <p>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</p> <p>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</p>
<p>Suggested Recommended Books:</p> <ol style="list-style-type: none"> 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	<p>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,</p> <p style="padding-left: 40px;">UV Spectral Analysis: Interpretation of UV spectra, Determination of molecular structure</p> <p>Determination of chemical bonding</p> <p>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</p>
	Module-3	<p>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</p> <p>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</p>
	Module-4	<p>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</p> <p>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</p>

	Module-5	<p>Ethers Epoxides: Definition and classification of ethers, Nomenclature of ethers, Physical and chemical properties of ethers</p> <p>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</p> <p>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</p>
	Module-6	<p>Aldehydes and Ketones: Definition and classification of aldehydes, Nomenclature of aldehydes</p> <p>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</p> <p>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</p>
	Module-7	<p>Aldehydes and Ketones: Definition and classification of aldehydes, Nomenclature of aldehydes</p> <p>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</p> <p>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</p> <p>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</p>
	Module-8	<p>Carboxylic Acids: Definition, classification & Nomenclature of carboxylic acids, Physical and chemical properties of carboxylic acids</p> <p>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</p> <p>Synthesis of carboxylic acids from alkyl halides</p>

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)	
4. "Inorganic 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	<p>Thermodynamics I- Definition and scope of thermodynamics, Thermodynamic systems and surroundings, Thermodynamic properties (temperature, pressure, volume), Thermodynamic processes (isothermal, adiabatic, isobaric)</p> <p>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</p> <p>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</p> <p>Thermochemical Calculations: Standard enthalpy changes, Calculation of internal energy and enthalpy, Application of Hess's Law, Thermodynamic data analysis</p>
	Module-3	<p>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</p> <p>Thermodynamic Cycles : Carnot cycle, Rankine cycle, Otto cycle, Thermodynamic efficiency</p> <p>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</p> <p>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</p> <p>Chemical Equilibrium: Equilibrium Constant & free energy, Thermodynamics derivation of law of mass action, Reaction isotherm & reaction isochore,</p>

	Module-4	<p>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</p> <p>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</p> <p>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</p>
	Module-5	<p>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</p>
<p>Suggested Recommended Books:</p> <ol style="list-style-type: none"> 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 ordered field, Limit point, Bolzano-Weierstrass theorem, Closed & open sets, Concepts of compactness & connectedness, Heine-Borel theorem, Holder inequality & Minkowski inequality, Metric space, Open & Closed 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 principle of convergence, 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 integrability, Mean value theorem of integral calculus, Fundamental theorem of integral calculus, Functions of bounded variations & total variations

<p>Suggested Recommended Books:</p> <ol style="list-style-type: none"> 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 & q/ 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 1 st order & 1 st Degree, Equations 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 & q, 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 1 st 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
<p>Suggested Recommended Books:</p> <ol style="list-style-type: none"> 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, Trapezoidal 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, Descartes' 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-Raphson 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]****Credit1
0L+0T+2P****Max.Marks:100(IA: 60,ETE:40)****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]

Credit1
0L+0T+2P

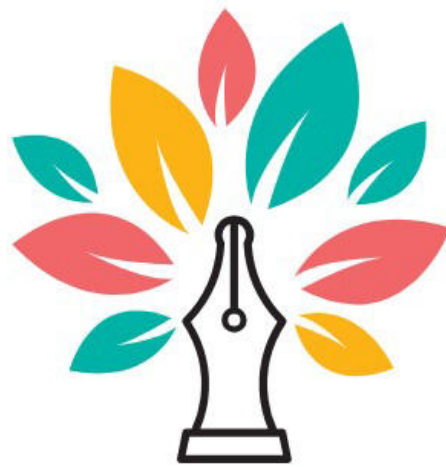
Max.Marks:100(IA: 60,ETE:40)

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

Teaching & Examination Scheme														
B.Sc.(PCM) 3rd Year														
Scheme Updated in Session July-2019, July-2020, July-2021, July-2022)														
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, MichelsonMorley 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, deuterium 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 molecules, 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	<ul style="list-style-type: none"> - Thermal Physics, S. Garg, R. Bansal and C. Ghosh, 1993, Tata McGraw-Hill. - A Treatise on Heat, MeghnadSaha, 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, Clausius-Clapeyron Equation, Expression for $(C_p - C_v)$, C_p/C_v , 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, Rayleigh-Jeans 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 | <ul style="list-style-type: none"> - 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 μ_{so} (spin only) and μ_{eff} 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 $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ 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. π acceptor 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 Ca^{2+} and Mg^{2+} , 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, SatyaPrakash.

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. Robinson annulations reaction.

Module-3	<p>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.</p>
Module-4	<p>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.</p> <p>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.</p>
Module-5	<p>A. INFRA-RED SPECTROSCOPY Basic principle, IR absorption Band their position and intensity, IR spectra of organic compounds.</p> <p>B. UV-VISIBLE SPECTROSCOPY Beer Lambert's law, effect of Conjugation, Types of electronic transitions λ_{max}, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption Visible spectrum and colour.</p> <p>C. NMR SPECTROSCOPY Basic principles of Proton Magnetic Resonance, Tetramethylsilane (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.</p>
Recommended Books	
	<ol style="list-style-type: none"> 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 H ₂ + 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,sp ² ,sp ³ Calculation of coefficients of A.O.'s used in these hybrid orbitals. Introduction to valence bond model of H ₂ , 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 Eastn.
4	The elements of Physical Chemistry P.W.Aikin,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: Integrability 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 Course 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 $R[x_1, x_2, \dots, x_n]$. 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. Propositional 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]

Credit1
0L+0T+2P

Max.Marks:100(IA:60,ETE:40)

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]

Credit1
0L+0T+2P

Max.Marks:100 (IA:60,ETE:40)

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 conductometrically
2. To study the saponification of ethyl acetate conductometrically
3. To study the strength of the give acid conductometrically using standard alkali solution

UNDERGRADUATE DEGREE COURSE

Bachelor of Science (CBZ)

July 23



University of Technology

Vatika Road, Jaipur Rajasthan 303903



UNDERGRADUATE DEGREE COURSE

Department of B.Sc.(CBZ) 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	Attain an 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

Bachelor of Science (CBZ) - 1st Year

JULY-2023



University of Technology

Vatika Road, Jaipur Rajasthan 303903



UNIVERSITY OF TECHNOLOGY, JAIPUR

Teaching & Examination Scheme

Bachelor of Science (CBZ) - 1st Year

B.Sc. (CBZ) - 1st Year (Scheme Updated in Session July-2019, July-2020, July-2021, July-2022, July-2023)														
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 Hour	Count Marks	Print Enable	Status	Update on New ERP
1	General Hindi	BCBZ 101	Theoretical	2	100	0	0	36	100	2	No	Yes	Yes	Yes
2	General English	BCBZ 102	Theoretical	2	100	0	0	36	100	2	No	Yes	Yes	Yes
3	Environmental Studies	BCBZ 103	Theoretical	2	100	0	0	36	100	2	No	Yes	Yes	Yes
4	Elementary Computer	BCBZ 104	Theoretical	1	60	0	0	22	60	1	No	Yes	Yes	Yes
5	Chemistry - I	BCBZ 105	Theoretical	3	50	0	0	18	50	3	Yes	Yes	Yes	Yes
6	Chemistry - II	BCBZ 106	Theoretical	3	50	0	0	18	50	3	Yes	Yes	Yes	Yes
7	Chemistry - III	BCBZ 107	Theoretical	3	50	0	0	18	50	3	Yes	Yes	Yes	Yes
8	Botany - I	BCBZ 108	Theoretical	3	50	0	0	18	50	3	Yes	Yes	Yes	Yes
9	Botany - II	BCBZ 109	Theoretical	3	50	0	0	18	50	3	Yes	Yes	Yes	Yes
10	Botany - III	BCBZ 110	Theoretical	3	50	0	0	18	50	3	Yes	Yes	Yes	Yes
11	Zoology - I	BCBZ 111	Theoretical	3	50	0	0	18	50	3	Yes	Yes	Yes	Yes
12	Zoology - II	BCBZ 112	Theoretical	3	50	0	0	18	50	3	Yes	Yes	Yes	Yes
13	Zoology - III	BCBZ 113	Theoretical	3	50	0	0	18	50	3	Yes	Yes	Yes	Yes
14	Computer Lab	BCBZ 151	Practical	1	40	0	0	14	40	2	No	Yes	Yes	Yes
15	Chemistry Lab	BCBZ 152	Practical	2	75	0	0	27	75	4	Yes	Yes	Yes	Yes
16	Botany Lab	BCBZ 153	Practical	2	75	0	0	27	75	4	Yes	Yes	Yes	Yes
17	Zoology Lab	BCBZ 154	Practical	2	75	0	0	27	75	4	Yes	Yes	Yes	Yes
				33+8	675	0	0	243	675	39+9				

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

E TE: End Term Exam, IA: Internal Assessment

Course Name- B.Sc.(CBZ) 1st Year	
Course Code- [BCBZ 101]	
Credits-6 (L: 3 T: 1 P: 0)	
Course Outcomes (COs)	
B.Sc.(CBZ) 1st Year	
Scheme Updated on Session - July-2019, July-2020, July-2021, July-2022, July-2023	
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 (patralekhan)
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	
	<ol style="list-style-type: none"> 1. "Hindi VyakaranaurRachna" by Dr. S. C. Gupta (Publication: Lakshya Publication) 2. "Hindi SahityakaItihas" by Dr.RamchandraShukla (Publication: Hindi SahityaSadan) 3. "Hindi Nibandh" by Dr. O. P. Singh (Publication: KitabMahal) 4. Hindi Vyakaran" by Dr. S. K. Mishra (Publication: BharatiBhawan) 5. "Hindi Rachna" by Dr. L. N. Sharma (Publication: Lakshya Publication) 6. "Hindi SahityakaSwaroop" by Dr. R. C. Sharma (Publication: Hindi SahityaSadan)

Course Name- B.Sc.(CBZ) 1st Year	
Course Code- [BCBZ 102]	
Credits-6 (L: 3 T: 1 P: 0)	
Course Outcomes (COs)	
B.Sc.(CBZ) 1st Year	
Scheme Updated on Session - July-2019, July-2020, July-2021, July-2022, July-2023	
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 (KitabMahal)
3. "English Grammar and Composition" by Wren and Martin (S. Chand Publishing)

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

Course Code- [BCBZ 103]

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

Course Outcomes (COs)

B.Sc.(CBZ) 1st Year

Scheme Updated on Session - July-2019, July-2020, July-2021, July-2022, July-2023

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 ErachBharucha (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- B.Sc.(CBZ) 1st Year

Course Code- BCBZ 104

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

Course Outcomes (COs)

B.Sc.(CBZ) 1st Year

Scheme Updated on Session - July-2019, July-2020, July-2021, July-2022, July-2023

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,scopeandoutcomeofthecourse.
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. (CBZ) - 1st Year

Course Code- [BCBZ 108]

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

Course Outcomes (COs)

B.Sc. (CBZ) - 1st Year

Scheme Updated on Session - July-2019, July-2020, July-2021, July-2022, July-2023

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 , ClF_3 , ICl_2 , H_2O Molecular Orbital theory: homonuclear & heteronuclear (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 & complexation 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), tetrasulphur, 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. (CBZ) - 1st Year

Course Code- [BCBZ 109]

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

Course Outcomes (COs)

B.Sc. (CBZ) - 1st Year

Scheme Updated on Session - July-2019, July-2020, July-2021, July-2022, July-2023

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 & Heterolytic bonds, Cleavage type of reagents, 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, stereogenic centers, Optical activities, Properties of enantiomers, chiral & achiral molecules with two stereogenic centers, Diastereomers, Resolution of enantiomers, Inversion, retention & racemization, Z system of nomenclature, Geometric Isomerism in oximes & alicyclic compounds Conformational Isomerism: Newman Projection & Sawhorse Formulae, Conformational 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 strain in rings Alkenes, Cycloalkenes, Dienes & Alkynes: Methods of Formation, mechanism of dehydration of alcohols & dehydrohalogenation of alkyl halides, Regioselectivity of Alcohol dehydration- the Saytzeff rule, Hoffmann elimination, Physical properties & relative stabilities, Chemical reaction of alkenes- mechanism involved in hydrogenation, electrophilic & free radical additions, Markovnikov'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. (CBZ) - 1st Year

Course Code- BCBZ 105

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

Course Outcomes (COs)

B.Sc. (CBZ) - 1st Year

Scheme Updated on Session - July-2019, July-2020, July-2021, July-2022, July-2023

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 , $\sin x$ & $\log x$, 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	<p>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</p> <p>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</p>
Module-4	<p>Solid States: Introduction to Solids, classification of solids, Crystal structures and unit cells, Lattice parameters and crystal systems</p> <p>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</p> <p>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</p>
Module-5	<p>Colloidal States: Introduction, Definition and importance of colloids, Types of colloids (lyophobic, lyophilic), Preparation methods (condensation, dispersion)</p> <p>Properties of Colloids: Brownian motion and sedimentation, Electrokinetic phenomena (electrophoresis, electroosmosis), Interfacial tension and surface energy, Viscosity and rheology of colloids</p>

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. (CBZ) -1st Year

Course Code- BCBZ 108

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

Course Outcomes (COs)

B.Sc. (CBZ) - 1st Year

Scheme Updated on Session - July-2019, July-2020, July-2021, July-2022, July-2023

Paper Name- Botany - I

Students will be able to:

- | | |
|-------------|--------------------------------------------|
| CO 1 | Explain plant cell structure and function. |
| CO 2 | Describe photosynthesis and respiration. |
| CO 3 | Understand plant morphology and anatomy. |

CO 4	Analyze plant diversity and classification.
CO 5	Prepare and analyze plant tissue sections.
Course Outline (CO)	
1	Unit-1/Introduction /4 Hours Per Week
2	Unit-2/Plant Cell Biology / 4 Hours Per Week
3	Unit-3/Photosynthesis and Respiration / 5 Hours Per Week
4	Unit-4/Plant Morphology and Anatomy / 5 Hours Per Week
5	Unit-5/ Plant Diversity and Classification /4 Hours Per Week
Detailed Syllabus	
Module-1	Introduction to objective, scope and outcome of the course
Module-2	Plant Cell Biology: Plant cell structure and function, Cell wall and membrane, Cytoplasm and organelles, Nucleus and chromosomes
Module-3	Photosynthesis and Respiration : Photosynthesis: light and dark reactions , Respiration: aerobic and anaerobic, Electron transport chain, ATP synthesis
Module-4	Plant Morphology and Anatomy: Plant body and its organization, Root and stem anatomy Leaf anatomy and morphology, Flower and fruit structure
Module-5	Plant Diversity and Classification : Kingdoms of life, Plant classification: artificial and natural Angiosperm classification, Plant identification using taxonomic keys
Recommended Books	
	1. Botany for Degree Students by A.C. Dutta 2. Plant Biology by Lincoln Taiz and Eduardo Zeiger 3. Botany by R.N. Singh
Course Name- B.Sc. (CBZ) -1st Year	
Course Code- BCBZ 109	
Credits-6 (L: 3 T: 1 P: 0)	
Course Outcomes (COs)	
B.Sc. (CBZ) - 1st Year	
Scheme Updated on Session - July-2019, July-2020, July-2021, July-2022, July-2023	
Paper Name- Botany - II	
Students will be able to:	
CO 1	Explain Mendelian genetics and chromosomal theory.
CO 2	Describe plant adaptations to environmental factors.
CO 3	Understand plant physiology and hormone regulation.
CO 4	Analyze diversity of Bryophytes, Pteridophytes, and Gymnosperms.
CO 5	Measure transpiration and photosynthesis rates.

Course Outline (CO)	
1	Unit-1/Introduction /4 Hours Per Week
2	Unit-2/Genetics and Evolution / 4 Hours Per Week
3	Unit-3/Plant Ecology / 5 Hours Per Week
4	Unit-4/Plant Physiology / 5 Hours Per Week
5	Unit-5/Bryophytes, Pteridophytes, and Gymnosperms /4 Hours Per Week

Detailed Syllabus

Module-1	Introduction to objective, scope and outcome of the course
Module-2	Genetics and Evolution : Mendelian genetics, Chromosomal theory of inheritance Gene expression and regulation, Evolution: mechanisms and evidence
Module-3	Plant Ecology : Ecosystems and community dynamics, Plant adaptations to environment Ecological succession, Conservation biology
Module-4	Plant Physiology : Water relations and transport, Mineral nutrition and uptake, Hormone regulation, Plant growth and development
Module-5	Bryophytes, Pteridophytes, and Gymnosperms: Bryophyte diversity and life cycle Pteridophyte diversity and life cycle, Gymnosperm diversity and life cycle, Comparative study of plant groups

Recommended Books

	<ol style="list-style-type: none"> 1. Botany for Degree Students by A.C. Dutta 2. Plant Biology by Lincoln Taiz and Eduardo Zeiger 3. Botany by R.N. Singh
--	---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

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

Course Code- BCBZ 110

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

Course Outcomes (COs)

B.Sc. (CBZ) - 1st Year

Scheme Updated on Session - July-2019, July-2020, July-2021, July-2022, July-2023

Paper Name- Botany - III

Students will be able to:

CO 1	Explain principles of plant taxonomy.
CO 2	Describe characteristics of major plant families.
CO 3	Understand phylogeny and evolution of plants.
CO 4	Analyze plant diversity and distribution.
CO 5	Prepare and analyze plant specimens

Course Outline (CO)

1	Unit-1/Introduction /4 Hours Per Week
----------	---------------------------------------

2	Unit-2/Plant Taxonomy / 4 Hours Per Week
3	Unit-3/Plant Diversity / 5 Hours Per Week
4	Unit-4/Phylogeny and Evolution / 5 Hours Per Week
5	Unit-5/Plant Families /4 Hours Per Week

Detailed Syllabus

Module-1	Introduction to objective, scope and outcome of the course
Module-2	Plant Taxonomy : Principles of plant taxonomy, Taxonomic hierarchy, Plant classification systems
Module-3	Plant Diversity : Angiosperm diversity, Gymnosperm diversity, Plant distribution and ecology
Module-4	Phylogeny and Evolution : Phylogenetic analysis, Plant evolution, Molecular systematics
Module-5	Plant Families : Fabaceae, Solanaceae, Poaceae

Recommended Books

1.	Plant Taxonomy by G. H. Maheshwari
2.	Botany for Degree Students by A. C. Dutta
3.	Plant Biology by Lincoln Taiz and Eduardo Zeiger

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

Course Code- BCBZ 111

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

Course Outcomes (COs)

B.Sc. (CBZ) - 1st Year

Scheme Updated on Session - July-2019, July-2020, July-2021, July-2022, July-2023

Paper Name- Zoology- I

Students will be able to:

CO 1	Explain animal diversity and classification.
CO 2	Describe cell structure and function.
CO 3	Understand tissue and organ organization.
CO 4	Analyze evolutionary relationships among animals.
CO 5	Identify and classify animal specimens.

Course Outline (CO)

1	Unit-1/Introduction /4 Hours Per Week
2	Unit-2/Animal Diversity/ 4 Hours Per Week
3	Unit-3/Cell Biology/ 5 Hours Per Week
4	Unit-4/Tissue and Organ Organization/ 5 Hours Per Week
5	Unit-5/Animal Morphology/4 Hours Per Week

Detailed Syllabus

Module-1	Introduction to objective, scope and outcome of the course
Module-2	Animal Diversity : Classification and phylogeny, Animal kingdoms (Monera to Animalia) Evolutionary relationships
Module-3	Cell Biology : Cell structure and function, Cellular transport and signalling, Cell division and genetics
Module-4	Tissue and Organ Organization: Epithelial and connective tissues, Muscle and nervous tissues, Organ systems (nervous, circulatory)
Module-5	Animal Morphology: Protozoa to Porifera, Cnidaria to Mollusca, Echinodermata to Chordata

Recommended Books

1.	Zoology by R. L. Kotpal
2.	Animal Biology by P. S. Verma
3.	Cell Biology by E. B. Lozanov

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

Course Code- BCBZ 111

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

Course Outcomes (COs)

B.Sc. (CBZ) - 1st Year

Scheme Updated on Session - July-2019, July-2020, July-2021, July-2022, July-2023

Paper Name- Zoology- II

Students will be able to:

CO 1	Explain animal physiology and homeostasis.
CO 2	Describe genetic principles and inheritance.
CO 3	Understand animal development and growth.
CO 4	Analyze ecological relationships among animals.
CO 5	Apply ecological principles to solve problem

Course Outline (CO)

1	Unit-1/Introduction /4 Hours Per Week
2	Unit-2/Animal Physiology/ 4 Hours Per Week
3	Unit-3/Genetics/ 5 Hours Per Week
4	Unit-4/Animal Development/ 5 Hours Per Week
5	Unit-5/Ecology/4 Hours Per Week

Detailed Syllabus

Module-1	Introduction to objective, scope and outcome of the course
Module-2	Animal Physiology : Homeostasis and regulation, Nervous and endocrine systems, Circulatory and respiratory systems
Module-3	Genetics : Mendelian genetics, Chromosomal genetics, Molecular genetics
Module-4	Animal Development : Embryology, Developmental biology, Growth and regeneration

Module-5	Ecology : Ecosystems and community dynamics, Population ecology, Conservation biology
Recommended Books	
1.	Animal Physiology by R. L. Kotpal
2.	Genetics by P. S. Verma
3.	Ecology by E. B. Lozanov
Course Name- B.Sc. (CBZ) -1st Year	
Course Code- BCBZ 113	
Credits-6 (L: 3 T: 1 P: 0)	
Course Outcomes (COs)	
B.Sc. (CBZ) - 1st Year	
Scheme Updated on Session - July-2019, July-2020, July-2021, July-2022, July-2023	
Paper Name- Zoology- III	
Students will be able to:	
CO 1	Explain animal behavior and social structure.
CO 2	Describe evolutionary mechanisms and processes.
CO 3	Understand biotechnological applications in zoology.
CO 4	Analyze conservation biology and wildlife management.
CO 5	Evaluate and analyze animal data.
Course Outline (CO)	
1	Unit-1/Introduction /4 Hours Per Week
2	Unit-2/Animal Behavior/ 4 Hours Per Week
3	Unit-3/Evolution / 5 Hours Per Week
4	Unit-4/Biotechnology / 5 Hours Per Week
5	Unit-5/Conservation Biology/4 Hours Per Week
Detailed Syllabus	
Module-1	Introduction to objective, scope and outcome of the course
Module-2	Animal Behavior: Behavioral ecology, Social behavior and communication, Learning and memory
Module-3	Evolution : Evolutionary mechanisms, Phylogeny and systematics, Molecular evolution
Module-4	Biotechnology : Genetic engineering, Biomedical applications, Conservation biotechnology
Module-5	Conservation Biology: Biodiversity and extinction, Wildlife management and conservation Ecological restoration
Recommended Books	
1.	Animal Behavior by J. R. Krebs
2.	Evolution by D. J. Futuyma
3.	Biotechnology by G. S. Manning

UNIVERSITY OF TECHNOLOGY, JAIPUR

Syllabus

1st Year B.Sc. (CBZ) - July-2022

ComputerLab [BCBZ 151]

Credit1
0L+0T+2P

Max.Marks:100(IA: 60,ETE:40)

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

Chemistry Lab[BCBZ152]

Credit1
0L+0T+2P

Max.Marks:100(IA: 60,ETE:40)

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 ₂ SO ₄ by studying the kinetics of hydrolysis of ethyl acetate
6	To study kinetically the reaction rate of decomposition of iodide by H ₂ O 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

UNIVERSITY OF TECHNOLOGY, JAIPUR

Syllabus

2nd Year B.Sc. (CBZ) - July-2022

Botony Lab[BCBZ153]

Credit1

Max.Marks:100(IA: 60,ETE:40)

0L+0T+2P

List of Experiments	
1	Plant Morphology: Study of root, stem, leaf, flower, and fruit, Measurement of plant parts, Drawing and labeling of plant structures.
2	Cell Biology: Study of plant cells and tissues, Preparation of temporary mounts. Observation of cell division.
3	Photosynthesis: Measurement of photosynthetic rate., Study of chlorophyll content, Effect of light intensity on photosynthesis.
4	Plant Identification: Study of plant families.,Identification of plants using taxonomic keys, Preparation of herbarium specimens.
5	Plant Physiology: Study of transpiration, Measurement of water potential, Effect of temperature on plant growth.
6	Microscopy: Study of microscope parts, Preparation of permanent mounts, Observation of plant tissues.

Zoology Lab[BCBZ154]

Credit1

Max.Marks:100(IA: 60,ETE:40)

0L+0T+2P

List of Experiments	
1	Study of Protozoa: Study of Amoeba, Paramecium, and Euglena., Preparation of temporary mounts, Observation of locomotion and feeding.
2	Study of Coelenterates: Study of Hydra and jellyfish, Observation of cnidoblasts. Study of regeneration.
3	Study of Annelids: Study of earthworm anatomy, Dissection and study of reproductive system, Observation of setae.
4	Study of Fish Anatomy: Dissection and study of external features, Study of skeletal and muscular systems, Observation of gills and scales.
5	Study of Fish Anatomy: Dissection and study of external features, Study of skeletal and muscular systems, Observation of gills and scales.
6	Study of Mammalian Anatomy: Study of rabbit anatomy, Dissection and study of internal organs. Observation of circulatory and nervous systems.

UNDERGRADUATE DEGREE COURSE

B.Sc. (CBZ) 2nd Year



University of Technology

Vatika Road, Jaipur Rajasthan 303903

B.Sc (CBZ) - 2nd 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	Chemistry - I	BCBZ 205	Theoretical	3	50	0	0	18	50	3
2	Chemistry - II	BCBZ 206	Theoretical	3	50	0	0	18	50	3
3	Chemistry - III	BCBZ 207	Theoretical	3	50	0	0	18	50	3
4	Botany - I	BCBZ 208	Theoretical	3	50	0	0	18	50	3
5	Botany - II	BCBZ 209	Theoretical	3	50	0	0	18	50	3
6	Botany - III	BCBZ 210	Theoretical	3	50	0	0	18	50	3
7	Zoology - I	BCBZ 211	Theoretical	3	50	0	0	18	50	3
8	Zoology - II	BCBZ 212	Theoretical	3	50	0	0	18	50	3
9	Zoology - III	BCBZ 213	Theoretical	3	50	0	0	18	50	3
10	Chemistry Lab	BCBZ 252	Practical	2	75	0	0	27	75	4
11	Botany Lab	BCBZ 253	Practical	2	75	0	0	27	75	4
12	Zoology Lab	BCBZ 254	Practical	2	75	0	0	27	75	4
				33	675	0	0	243	675	39

Course Name-B.Sc. (CBZ) - 2nd Year	
Course Code-[BCBZ 305]	
Credits-6 (L-18 h/T-18h)	
Course Outcomes (COs)	
B.Sc.(CBZ) - 2nd Year	
[BCBZ 305]: 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
<p>Suggested Recommended Books:</p> <ol style="list-style-type: none"> 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. (CBZ) - 2nd Year
Course Code-[BCBZ 305]
Credits-6 (L-18 h/T-18h)

Course Outcomes (COs)	
B.Sc. (CBZ) - 2nd Year	
BCBZ 305: 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	<p>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,</p> <p style="padding-left: 40px;">UV Spectral Analysis: Interpretation of UV spectra, Determination of molecular structure</p> <p>Determination of chemical bonding</p> <p>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</p>

	Module-3	<p>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</p> <p>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</p>
	Module-4	<p>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</p> <p>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</p>
	Module-5	<p>Ethers Epoxides: Definition and classification of ethers, Nomenclature of ethers, Physical and chemical properties of ethers</p> <p>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</p> <p>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</p>
	Module-6	<p>Aldehydes and Ketones: Definition and classification of aldehydes, Nomenclature of aldehydes</p> <p>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</p> <p>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</p>

	Module-7	<p>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</p> <p>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</p> <p>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</p>
	Module-8	<p>Carboxylic Acids: Definition, classification & Nomenclature of carboxylic acids, Physical and chemical properties of carboxylic acids</p> <p>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</p>
	Module-9	<p>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</p>
<p>Suggested Recommended Books:</p> <ol style="list-style-type: none"> 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) 4. "Inorganic 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. (CBZ) - 2nd Year	
Course Code-[BCBZ 305]	
Credits-6 (L-18 h/T-18h)	
	Course Outcomes (COs)
	B.Sc.(CBZ) - 2nd Year

BCBZ 305: 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	<p>Thermodynamics I- Definition and scope of thermodynamics, Thermodynamic systems and surroundings, Thermodynamic properties (temperature, pressure, volume), Thermodynamic processes (isothermal, adiabatic, isobaric)</p> <p>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</p> <p>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</p> <p>Thermochemical Calculations: Standard enthalpy changes, Calculation of internal energy and enthalpy, Application of Hess's Law, Thermodynamic data analysis</p>

	<p>Module-3</p>	<p>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</p> <p>Thermodynamic Cycles : Carnot cycle, Rankine cycle, Otto cycle, Thermodynamic efficiency</p> <p>Concept of Entropy: Definition and units of entropy, Entropy change and heat transfer, Entropy change equations (Clausius, Gibbs), Isothermal, adiabatic, and isobaric processes</p> <p>Phase transitions and entropy, Entropy changes in thermodynamic cycles, Entropy and thermodynamic efficiency</p> <p>Third Law of Thermodynamics: Statement of the Third Law, Entropy at absolute zero</p> <p>Implications of the Third Law, Applications of the Third Law, Thermodynamic systems at low temperatures, Entropy changes at low temperatures</p> <p>Chemical Equilibrium: Equilibrium Constant & free energy, Thermodynamics derivation of law of mass action, Reaction isotherm & reaction isochore,</p>
	<p>Module-4</p>	<p>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</p> <p>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</p> <p>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</p>

	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
<p>Suggested Recommended Books:</p> <ol style="list-style-type: none"> 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.(BCBZ) - 2nd Year	
Course Code-[BCBZ308]	
Credits-6 (L-18 h/T-18h)	
Course Outcomes (COs)	
B.Sc.(BCBZ) - 2nd Year	
[BCBZ308]: -Botony-I	
Students will be able to:	
CO 1	Explain the principles of plant anatomy and morphology.
CO 2	Describe the structure and function of plant cells and tissues.
CO 3	Understand the process of photosynthesis and respiration in plants.
CO 4	Analyze the diversity of plant families and their characteristics.
Course Outline (CO)	
1	Unit-1/Introduction/4 Hours Per Week
2	Unit-2/Plant Anatomy / 4 Hours Per Week
3	Unit-3/Plant Morphology/ 5 Hours Per Week
4	Unit-4/Photosynthesis and Respiration/ 5 Hours Per Week
5	Unit-4/Plant Diversity / 5 Hours Per Week

Detailed Syllabus	
Module-1	Introduction to objective, scope and outcome of the course.
Module-2	Plant Anatomy: Plant cell structure and function, Tissue organization and differentiation, Meristems and plant growth
Module-3	Plant Morphology: Root and stem anatomy, Leaf and flower morphology, Fruit and seed development
Module-4	Photosynthesis and Respiration : Light-dependent reactions, Light-independent reactions, Respiration and energy production
Module-5	Plant Diversity : Plant classification and phylogeny, Characteristics of major plant families, Plant evolution and adaptation
Suggested Recommended Books:	
1. Plant Anatomy by A. Fahn 2. Plant Morphology by R. C. Sharma 3. Photosynthesis by D. O. Hall	

Course Name-B.Sc.(BCBZ) - 2nd Year	
Course Code-[BCBZ309]	
Credits-6 (L-18 h/T-18h)	
Course Outcomes (COs)	
B.Sc.(BCBZ) - 2nd Year	
[BCBZ308]: -Botony-II	
Students will be able to:	
CO 1	Explain the principles of plant physiology and biochemistry.
CO 2	Describe the processes of plant growth and development.
CO 3	Understand the mechanisms of plant defense and stress responses.
CO 4	Analyze the role of plants in ecology and conservation.
Course Outline (CO)	
1	Unit-1/Introduction/4 Hours Per Week
2	Unit-2/Plant Physiology / 4 Hours Per Week
3	Unit-3/Plant Growth and Development / 5 Hours Per Week
4	Unit-4/Plant Defense and Stress Responses/ 5 Hours Per Week
5	Unit-4/Plant Ecology and Conservation/ 5 Hours Per Week
Detailed Syllabus	
Module-1	Introduction to objective, scope and outcome of the course.

Module-2	Plant Physiology : Water relations and transport, Mineral nutrition and transport, Photosynthesis and respiration
Module-3	Plant Growth and Development: Hormone regulation of growth and development, Cell division and differentiation, Tissue and organ development
Module-4	Plant Defense and Stress Responses : Mechanisms of plant defense against pathogens, Plant responses to abiotic stress, Plant stress physiology
Module-5	Plant Ecology and Conservation : Plant ecology and ecosystems Plant conservation and biodiversity, Ecological restoration and management
Suggested Recommended Books:	
1. Plant Physiology by L. Taiz and E. Zeiger	
2. Plant Growth and Development by P. J. Davies	
3. Plant Defense and Stress Responses by R. K. Singh	

Course Name-B.Sc.(BCBZ) - 2nd Year	
Course Code-[BCBZ308]	
Credits-6 (L-18 h/T-18h)	
Course Outcomes (COs)	
B.Sc.(BCBZ) - 2nd Year	
[BCBZ308]: -Botony-II	
Students will be able to:	
CO 1	Explain the principles of plant ecology and conservation.
CO 2	Describe the processes of plant evolution and diversity.
CO 3	Understand the mechanisms of plant defense and stress responses.
CO 4	Analyse the role of plants in ecosystem services and human well-being.
Course Outline (CO)	
1	Unit-1/Introduction/4 Hours Per Week
2	Unit-2/Plant Ecology/ 4 Hours Per Week
3	Unit-3/Plant Evolution and Diversity/ 5 Hours Per Week
4	Unit-4/Plant Defence and Stress Responses / 5 Hours Per Week
5	Unit-4/Ecosystem Services and Human Well-being/ 5 Hours Per Week
Detailed Syllabus	

Module-1	Introduction to objective, scope and outcome of the course.
Module-2	Plant Ecology : Plant communities and ecosystems, Plant population ecology, Plant community ecology
Module-3	Plant Evolution and Diversity : Mechanisms of plant evolution Plant phylogeny and systematics, Plant diversity and conservation
Module-4	Plant Defense and Stress Responses : Mechanisms of plant defense against pathogens, Plant responses to abiotic stress, Plant stress physiology
Module-5	Ecosystem Services and Human Well-being : Ecosystem services and human well-being, Plant-based solutions for ecosystem services, Sustainable use of plant resources
Suggested Recommended Books:	
1. Plant Ecology by M. C. F. Proctor	
2. Plant Evolution and Diversity by P. H. Raven	
3. Plant Defense and Stress Responses by R. K. Singh	

Course Name-B.Sc.(BCBZ) - 2nd Year	
Course Code-[BCBZ310]	
Credits-6 (L-18 h/T-18h)	
Course Outcomes (COs)	
B.Sc.(BCBZ) - 2nd Year	
[BCBZ310]: -Botony-III	
Students will be able to:	
CO 1	Explain the principles of plant biotechnology and genetic engineering.
CO 2	Describe the processes of plant tissue culture and micropropagation.
CO 3	Understand the mechanisms of plant molecular biology and genomics.
CO 4	Analyze the applications of plant biotechnology in agriculture and industry.
CO 5	Collect data and interpret results from plant biotechnology experiments.
Course Outline (CO)	
1	Unit-1/Introduction/4 Hours Per Week
2	Unit-2/Plant Biotechnology/ 4 Hours Per Week
3	Unit-3/Plant Molecular Biology/ 5 Hours Per Week
4	Unit-4/Plant Genetic Engineering/ 5 Hours Per Week
5	Unit-4/Plant Biotechnology/ 5 Hours Per Week
Detailed Syllabus	

Module-1	Introduction to objective, scope and outcome of the course.
Module-2	Plant Biotechnology: Introduction to plant biotechnology, Plant genetic engineering, Plant tissue culture and micropropagation
Module-3	Plant Molecular Biology :Plant genome organization and structure Plant gene expression and regulation, Plant molecular markers and genomics
Module-4	Plant Genetic Engineering : Principles of genetic engineering Plant transformation and regeneration, Gene editing and genome editing
Module-5	Plant Biotechnology: Plant biotechnology in agriculture Plant biotechnology in industry, Plant biotechnology in medicine
Suggested Recommended Books: 1. Animal Physiology by R. L. Kotpal 2. Animal Development and Growth by S. F. Gilbert 3. Animal Behavior and Ecology by J. R. Krebs	

Course Name-B.Sc.(BCBZ) - 2nd Year	
Course Code-[BCBZ313]	
Credits-6 (L-18 h/T-18h)	
Course Outcomes (COs)	
B.Sc.(BCBZ) - 2nd Year	
[BCBZ313]: Zoology-I	
Students will be able to:	
CO 1	Explain the principles of animal diversity and evolution.
CO 2	Describe the characteristics of major animal phyla.
CO 3	Understand the mechanisms of animal development and growth.
CO 4	Analyze the diversity of animal habitats and ecosystems.
CO 5	Apply knowledge of animal diversity and ecology to solve problems.
Course Outline (CO)	
1	Unit-1/Introduction/4 Hours Per Week
2	Unit-2/ Animal Diversity and Evolution/ 4 Hours Per Week
3	Unit-3/ Characteristics of Major Animal Phyla/ 5 Hours Per Week
4	Unit-4/Animal Development and Growth / 5 Hours Per Week
5	Unit-5/Animal Habitats and Ecosystems / 5 Hours Per Week
Detailed Syllabus	

Module-1	Introduction to objective, scope and outcome of the course.
Module-2	Animal Diversity and Evolution: Introduction to animal diversity Mechanisms of evolution, Phylogenetic relationships among animal phyla
Module-3	Characteristics of Major Animal Phyla : Characteristics of Porifera and Coelenterata, Characteristics of Platyhelminthes and Nematoda Characteristics of Annelida and Arthropoda
Module-4	Animal Development and Growth : Embryonic development Fetal development and birth, Postnatal growth and development
Module-5	Animal Habitats and Ecosystems : Introduction to animal habitats and ecosystems, Terrestrial and freshwater ecosystems, Marine ecosystems and conservation
Suggested Recommended Books: 1. Animal Diversity and Evolution by R. S. K. Barnes 2. Invertebrate Zoology by E. E. Ruppert 3. Animal Development and Growth by S. F. Gilbert	

Course Name-B.Sc.(BCBZ) - 2nd Year	
Course Code-[BCBZ312]	
Credits-6 (L-18 h/T-18h)	
Course Outcomes (COs)	
B.Sc.(BCBZ) - 2nd Year	
[BCBZ312]: Zoology-II	
Students will be able to:	
CO 1	Explain the principles of animal physiology and biochemistry.
CO 2	Describe the processes of animal nutrition and digestion.
CO 3	Understand the mechanisms of animal respiration and circulation.
CO 4	Analyze the diversity of animal behavior and ecology.
CO 5	Apply knowledge of animal physiology and ecology to solve problems.
Course Outline (CO)	
1	Unit-1/Introduction/4 Hours Per Week
2	Unit-2/ Animal Physiology/ 4 Hours Per Week
3	Unit-3/Animal Nutrition and Digestion / 5 Hours Per Week
4	Unit-4/ Animal Respiration and Circulation/ 5 Hours Per Week
5	Unit-5/ Animal Behavior and Ecology/ 5 Hours Per Week

Detailed Syllabus	
Module-1	Introduction to objective, scope and outcome of the course.
Module-2	Animal Physiology : Introduction to animal physiology, Nervous and muscular systems, Circulatory and respiratory systems
Module-3	Animal Nutrition and Digestion : Introduction to animal nutrition Digestion and absorption of nutrients, Nutritional disorders and deficiencies
Module-4	Animal Respiration and Circulation : Introduction to animal respiration, Gas exchange and transport, Circulatory system and blood
Module-5	Animal Behavior and Ecology : Introduction to animal behavior Behavioral adaptations and evolution, Ecological principles and conservation
Suggested Recommended Books:	
1. Animal Physiology by R. L. Kotpal	
2. Animal Nutrition and Digestion by P. J. Reeds	
3. Animal Respiration and Circulation by W. D. Hardison	

Course Name-B.Sc.(BCBZ) - 2nd Year	
Course Code-[BCBZ312]	
Credits-6 (L-18 h/T-18h)	
Course Outcomes (COs)	
B.Sc.(BCBZ) - 2nd Year	
[BCBZ312]: Zoology-III	
Students will be able to:	
CO 1	Explain the principles of animal physiology and biochemistry.
CO 2	Describe the processes of animal nutrition and digestion.
CO 3	Understand the mechanisms of animal respiration and circulation.
CO 4	Analyze the diversity of animal behavior and ecology.
CO 5	Apply knowledge of animal physiology and ecology to solve problems.
Course Outline (CO)	
1	Unit-1/Introduction/4 Hours Per Week
2	Unit-2/Animal Physiology/ 4 Hours Per Week
3	Unit-3/Animal Nutrition and Digestion/ 5 Hours Per Week
4	Unit-4/Animal Respiration and Circulation/ 5 Hours Per Week

5	Unit-5/ Animal Behavior and Ecology/ 5 Hours Per Week
Detailed Syllabus	
Module-1	Introduction to objective, scope and outcome of the course.
Module-2	Animal Physiology: Introduction to animal physiology Nervous and muscular systems, Circulatory and respiratory systems
Module-3	Animal Nutrition and Digestion : Introduction to animal nutrition Digestion and absorption of nutrients, Nutritional disorders and deficiencies
Module-4	Animal Respiration and Circulation : Introduction to animal respiration, Gas exchange and transport, Circulatory system and blood
Module-5	Animal Behavior and Ecology : Introduction to animal behavior Behavioral adaptations and evolution, Ecological principles and conservation
Suggested Recommended Books: 1. Animal Physiology by R. L. Kotpal 2. Animal Nutrition and Digestion by P. J. Reeds 3. Animal Respiration and Circulation by W. D. Hardison	

UNIVERSITY OF TECHNOLOGY, JAIPUR

Syllabus

2nd Year B.Sc. (CBZ) - July-2022)

Chemistry Lab [BCBZ 252]

Credit1

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

Botony Lab [BCBZ 253]

Credit1

Max.Marks:100(IA: 60,ETE: 40)

0L+0T+2P

List of Experiments	
1	Plant Anatomy: Study of plant cells and tissues, Identification of plant organs and structures
2	Plant Morphology: Study of plant habit and growth forms, Identification of plant families and genera
3	Plant Physiology: Study of photosynthesis and respiration, Measurement of plant growth and development
4	Plant Ecology : Study of plant communities and ecosystems, Analysis of plant diversity and conservation

Zoology Lab [BCBZ 254]

Credit1

Max.Marks:100(IA: 60,ETE: 40)

0L+0T+2P

List of Experiments	
1	Animal Diversity and Evolution: Study of animal phyla and classes, Identification of animal specimens
2	Animal Physiology: Study of animal systems (nervous, circulatory, respiratory), Measurement of physiological parameters
3	Animal Biochemistry: Study of animal metabolism and bioenergetics, Analysis of biochemical compounds
4	Animal Ecology : Study of animal habitats and ecosystems, Analysis of ecological principles and conservation

UNDERGRADUATE DEGREE COURSE

Bachelor of Science (CBZ)

3rd Year



University of Technology

Vatika Road, Jaipur

Rajasthan 303903

B.Sc. (CBZ) - 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
1	Chemistry - I	BCBZ 305	Theoretical	3	50	0	0	18	50	3
2	Chemistry - II	BCBZ 306	Theoretical	3	50	0	0	18	50	3
3	Chemistry - III	BCBZ 307	Theoretical	3	50	0	0	18	50	3
4	Botany - I	BCBZ 308	Theoretical	3	50	0	0	18	50	3
5	Botany - II	BCBZ 309	Theoretical	3	50	0	0	18	50	3
6	Botany - III	BCBZ 310	Theoretical	3	50	0	0	18	50	3
7	Zoology - I	BCBZ 311	Theoretical	3	50	0	0	18	50	3
8	Zoology - II	BCBZ 312	Theoretical	3	50	0	0	18	50	3
9	Zoology - III	BCBZ 313	Theoretical	3	50	0	0	18	50	3
10	Chemistry Lab	BCBZ 352	Practical	2	75	0	0	27	75	4
11	Botany Lab	BCBZ 353	Practical	2	75	0	0	27	75	4
12	Zoology Lab	BCBZ 354	Practical	2	75	0	0	27	75	4

*L: Lecture, T: Tutorial, P: Practical, Cr: Credits
ETE: EndTermExam, IA: InternalAssessment*

Course Name-B.Sc.(BCBZ) – 3rd Year	
Course Code-[BCBZ305]	
Credits-6 (L-18 h/T-18h)	
	B.Sc.(BCBZ) – 3rd Year
	[BCBZ305]: Chemistry-I

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 μ_{so} (spin only) and μ_{eff} 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 $[Ti(H_2O)_6]^{3+}$ 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. π acceptor 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 Ca^{2+} and Mg^{2+} , 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, SatyaPrakash.

Course Name-Chemistry - II

Course Code- BCBZ306

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. Robinson 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	<p>A. INFRA-RED SPECTROSCOPY Basic principle, IR absorption Band their position and intensity, IR spectra of organic compounds.</p> <p>B. UV-VISIBLE SPECTROSCOPY Beer Lambert's law, effect of Conjugation, Types of electronic transitions λ_{max}, Chromophores and Auxochromes, Bathochromic and Hypsochromic shifts, Intensity of absorption Visible spectrum and colour.</p> <p>C. NMR SPECTROSCOPY Basic principles of Proton Magnetic Resonance, Tetramethylsilane (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.</p>
----------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

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-BCBZ307

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	<p>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.</p>
Module-2	<p>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.</p>
Module-3	<p>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</p>
Module-4	<p>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.</p>
Module-5	<p>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</p>

	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 Eastn.
4	The elements of Physical Chemistry P.W.Aikin,Oxford.
5	Physical Chemistry through problems, S.K.Dogra, Wiley Eastern.
6	Physical Chemistry B.D.Khosla.
7	Physical Chemistry, Puri& Sharma

Course Name-Botony-I

Course Code-BCBZ308

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

Course Outcomes (COs)	
CO 1	Structure and functions of the Nucleus: Ultrastructure, nuclear functions, and more
CO 2	Estimation of DNA, RNA, and protein
CO 3	Study of plant cells and tissues
CO 4	Identification of plant organs and structures

Course Outline (CO)	
1	Unit-1/ Definition /5 Hours Per Week
2	Unit-2/Biotechnology (Applied microbiology & Genetic engineering)/ 6 Hours Per Week
3	Unit-3/Genetic Engineering/ 7 Hours Per Week
4	Unit-4/Plant Pathology/ 7 Hours Per Week
5	Unit-5/A brief history of anther and ovule /6 Hours Per Week
6	Unit-6/ General account of Bryophytes /6 Hours Per Week

Detailed Syllabus	
--------------------------	--

Module-1	Biotechnology (Applied microbiology & Genetic engineering) Microbiology and Applied microbiology: Definition and scope: An elementary knowledge of soil, water, sewage, milk, food, air, and industrial microbiology; importance and application of Penicillium, Bacillus, Chlorella, Streptococcus, Lactobacillus, Leuconostoc, Saccharomyces, Aspergillus, Clostridium, and Claviceps; symbiotic and non-symbiotic nitrogen-fixing bacteria; and blue-
----------	----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------

	green algae; Mycorrhiza
Module-2	Genetic Engineering: Concept & scope: gene transplant, role of restriction enzymes, endonucleases; plasmids in transferring gene; application of genetic engineering in medicine, agriculture, industry and environment
Module-3	Plant Pathology: Definition and scope: disease and disease-causing organisms; symptoms of plant diseases; dissemination of pathogens; introductory knowledge of epidemiology and forecasting of plant diseases; host-parasite interaction; effect of environment on plant diseases; principles of defence mechanisms and control
Module-4	A brief history of anther and ovule; Male gametophytes, Polygonum type of embryo sac; fertilization, development of embryo sac as exemplified by Capsella bursa-pastoris and Sagittaria type; An elementary account of the development of endosperm ; apomixes and polyembryony
Module-5	Bryophyta: A general account of Bryophytes; the life histories of the following genera: Hepaticopsida: Riccia, Marchantia, Porella Anthocerotopsida: Anthoceros Bryopsida: Sphagnum, Funaria

Recommended Books

1	"Fungi" by M. J. Carlile - A comprehensive textbook on fungi, covering topics such as fungal structure, physiology, and ecology.
2	"Lichens" by A. Fletcher - A detailed textbook on lichens, covering topics such as lichen structure, physiology, and ecology.
3	"Plant Physiology" by L. Taiz and E. Zeiger - A comprehensive textbook on plant physiology, covering topics such as photosynthesis, respiration, and plant growth.
4	"Plant Biochemistry" by P. M. Dey and J. B. Harborne - A textbook on plant biochemistry, covering topics such as plant metabolism, enzymes, and biochemical pathways.

Course Name-Botony-II

Course Code-BCBZ309

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

Course Outcomes (COs)

CO 1	Explain the principles of ecology, evolution, and conservation biology.
CO 2	Describe the diversity of animal behavior, including social behavior, communication, and learning.
CO 3	Understand the biology of wildlife, including population dynamics, community ecology, and ecosystem management.
CO 4	Analyze the principles of animal biotechnology, including genetic engineering and gene cloning.

Course Outline (CO)

1	Unit-1/ Definition /5 Hours Per Week
2	Unit-2/ Plant Pathology/ 6 Hours Per Week
3	Unit-3/ Applied Plant Anatomy and Plant Breeding Applied plant anatomy / 7 Hours Per Week
4	Unit-4/Plant Breeding/ 7 Hours Per Week
5	Unit-5/Marine Biology and Limnology /6 Hours Per Week

Detailed Syllabus

Module-1	Plant Pathology: Definition and scope: disease and disease-causing organisms; symptoms of plant diseases; dissemination of pathogens; introductory knowledge of epidemiology and forecasting of plant diseases; host-parasite interaction; effect of environment on plant diseases; principles of defence mechanisms and control, h) Rubber: Havea, Ficus i) Tannins: Acacia j) Gum: Acacia, Sterculia, k) Weeds and weed control: An introduction and definition of weeds; methods of weed control, a basic knowledge of herbicides, their transformation and persistence in soil; some prominent weeds of crop plants and their control
Module-2	Applied Plant Anatomy and Plant Breeding Applied plant anatomy: Economic aspect of applied plant anatomy in taxonomy, horticulture, food adulteration, medicinal plants; wood in present day archaeology, forensic application
Module-3	Plant Breeding: An elementary knowledge of plant breeding, methods of breeding of self-pollinated crops, cross-pollinated crops, and asexually propagated crops, parasexuality, techniques of plant breeding: emasculation, pollination etc
Module-4	Marine Biology and Limnology: An elementary knowledge of marine biology and limnology; a general study of morphological and reproductive features of micro and macrophytes growing in sea water with special reference to their adaptations; a preliminary knowledge of abiotic (Physicochemical properties of water) and biotic (planktons, periphytons, macrophytes, benthos and decomposes) factors influencing growth of fresh water and marine water flora

Recommended Books

1	- Ecology" by Robert E. Ricklefs
2	- "Evolution" by Mark Ridley
3	- "Conservation Biology" by Gary K. Meffe
4	- "Animal Behavior" by James L. Gould
5	- Wildlife Biology" by Raymond F. Dasmann
6	- "Animal Biotechnology" by David M. Glover

Course Name-Botony-III

Course Code- BCBZ310

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

Course Outcomes (COs)	
CO 1	Explain the principles of plant physiology, including photosynthesis, respiration, and plant growth.
CO 2	Describe the diversity of plant ecosystems, including forests, grasslands, and wetlands.
CO 3	Understand the concepts of ecological succession, community dynamics, and biodiversity.
CO 4	Analyze data and interpret data
CO 5	Compare, validate & conclude the results
Course Outline (CO)	
1	Unit-1/ Definition /5 Hours Per Week
2	Unit-2/PALAEOBOTANY/ 6 Hours Per Week
3	Unit-3/PLANT DIVERSIFICATION / 7 Hours Per Week
4	Unit-4/Morphogenesis and Tissue Culture/ 7 Hours Per Week
5	Unit-5/Types of life cycles /6 Hours Per Week
6	Unit-6/ Ecology of Algae /6 Hours Per Week
Detailed Syllabus	
Module-1	PALAEOBOTANY: An elementary knowledge of Palaeobotany; geological era; process of fossilization; types of fossils; methods of fossil study; form genera and reconstruction of fossil plants PALYNOLOGY: An introductory knowledge of palynology
Module-2	PLANT DIVERSIFICATION: Evolutionary trends; origin and evolution of different plant groups
Module-3	Morphogenesis and Tissue Culture: Phenomenon of morphogenesis;; an elementary knowledge of polarity, symmetry; cellular and tissue differentiation; protoplast fusion, methodology and application of tissue culture
Module-4	Types of life cycles – Haplontic, Diplontic, Diplohaplontic, Haplodiplontic and Diplobiontic; Alternation of generation in Algae.
Module-5	Ecology of Algae: Brief idea of freshwater and marine, terrestrial, epiphytic, parasitic, symbiotic algae and phytoplanktons. Economic importance of algae as food, fodder, in agriculture, industry and public health.
Reference Books	
1	"Plant Physiology" by L. Taiz and E. Zeiger
2	"Ecology" by R. E. Ricklefs
3	"Plant Ecology" by J. L. Harper

Course Name-Botony III		
Course Code- BCBZ310		
Credits-3 (L-18 h/T-18h)		
Course Outcomes (COs)		
CO 1	Explain the principles of genetics, molecular biology, and biotechnology.	
CO 2	Describe the structure and function of cell and cell organelles.	
CO 3	Understand the organization and morphology of chromosomes.	
CO 4	Analyze the general characteristics of algae and its position in the plant kingdom.	
CO 5	Apply knowledge of botany to solve problems	
Course Outline (CO)		
1	Unit-1/ Structure and functions of Nucleus /5 Hours Per Week	
2	Unit-2/Cell division / 6 Hours Per Week	
3	Unit-3/Genetic Inheritance / 7 Hours Per Week	
4	Unit-4/DNA-the genetic material/ 7 Hours Per Week	
5	Unit-5/Introduction to Biotechnology /6 Hours Per Week	
Detailed Syllabus		
Module-1	Structure and functions of Nucleus: Ultra structure, nuclear membrane, nucleolus, structure and functions of other cell organelles: Golgi body, endoplasmic reticulum, peroxysomes and vacuoles. The cell envelope: Plasma membrane, bilayer lipid structure and functions of cell wall.	
Module-2	Cell division: Comparasion of mitosis and meiosis Chromosome organization: Morphology, centromere and telomere, chromosome alteration in chromosome numbers, aneuploidy, polyploidy and sex chromosomes. Extra nuclear genome: Presence and functions of mitochondrial and plastid DNA, plasmids.	
Module-3	Genetic Inheritance: Mendelism: Law of segregation and independent assortment, incomplete dominance. Interaction of genes: Linkage- complete and incomplete linkage and crossing over.	
Module-4	DNA-the genetic material: DNA structure, replication, DNA- protein interaction, the nucleosome model, satellite and repetitive DNA. RNA: Structure and types. Gene concept: Classical and modern concept of gene, operon concept.	

Module-5	Introduction to Biotechnology: Functional definition, role in modern life, history and ethical issues connected with biotechnology. Genetic engineering: Tools and techniques of DNA technology, cloning vectors, genome, cDNA libraries, transposable elements and techniques of gene mapping
Reference Books	
1	Gupta P.K. 2000. Cytology, Genetics And Evolution. Rastogi Publication, Meerut
2	Gupta P.K. 2012. Genetics. Rastogi Publication, Meerut
3	Gupta P.K. 2001. Elements of Biotechnology. Rastogi Publication, Meerut
4	Power, C.B. 1994. Cell Biology. Himalaya Publishing House, New Delhi
Course Name- Zoology I	
Course Code- BCBZ311	
Credits-3 (L-18 h/T-18h)	
Course Outcomes (COs)	
CO 1	Explain the principles of physiology, genetics, and molecular biology in animals.
CO 2	Describe the diversity of animal life, including non-chordates and chordates.
CO 3	Understand the biology of fish, including their anatomy, physiology, and behavior
CO 4	Analyze the principles of fisheries management and conservation
CO 5	Apply knowledge of zoology to solve problems
Course Outline (CO)	
1	Unit-1/ Definition /5 Hours Per Week
2	Unit-2/Physiology/ 6 Hours Per Week
3	Unit-3/Respiration / 7 Hours Per Week
4	Unit-4/ Sensory System / 7 Hours Per Week
Detailed Syllabus	
Module-1	Physiology: Nutritive substances, Enzymes and Energetics: Biological role of nutritive substances. Metabolism and metabolic pathways. Bioenergetics. General properties and mechanism of action of enzymes. Cofactors and Coenzymes. Factors influencing enzyme activity Digestion: Digestion and absorption of nutrient. Gastrointestinal secretions and its regulation
Module-2	Respiration: Respiratory mechanism. Respiratory pigments. Respiratory gases. Regulation of respiration. Circulation: Blood groups. Haemostasis and blood coagulation. Conduction system of the heart. Cardiac output and its control

Module-3	Excretion: Excretion and excretory products in animals. Mechanism of urine formation. Role of kidney in the maintenance of electrolyte balance &pH. Nervous System: Nerve cells and electrical signaling. Synaptic transmission and neuronal integration Endocrine System: Primary endocrine glands, respective hormones and their functions.
Module-4	Sensory System: General principles of sensory physiology:- vision, hearing and balance, taste, smell and touch Reproduction and Development: Female reproductive cycle (ovarian and uterine cycles in human). Gametogenesis. Types of eggs. Mechanism of fertilization. Embryonic development.

Recommended Books

1	"Fish Physiology" by David H. Evans - A comprehensive textbook on fish physiology, covering topics such as anatomy, physiology, and behavior.
2	"Fisheries Science: An Introduction" by Michael L. Peterson - A textbook on fisheries science, covering topics such as fisheries management, conservation, and ecology.
3	"Aquaculture: Principles and Practices" by T. V. R. Pillay - A textbook on aquaculture, covering topics such as fish farming, fisheries management, and conservation.

Course Name- Zoology II

Course Code- BCBZ312

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

Course Outcomes (COs)

CO 1	Explain the principles of ecology, evolution, and conservation biology.
CO 2	Describe the diversity of animal behavior, including social behavior, communication, and learning.
CO 3	Understand the biology of wildlife, including population dynamics, community ecology, and ecosystem management.
CO 4	Analyze the principles of animal biotechnology, including genetic engineering and gene cloning.
CO 5	Apply knowledge of zoology to solve problems.

Course Outline (CO)

1	Unit-1/ Introduction to Natural Resources and Management /5 Hours Per Week
2	Unit-2/Water Resource/ 6 Hours Per Week
3	Unit-3/Land resource / 7 Hours Per Week
4	Unit-4/Mineral resource/ 7 Hours Per Week
5	Unit-5/ Biodiversity Resource /6 Hours Per Week

Detailed Syllabus

Module-1	Introduction to Natural Resources and Management: Concept, values and types. Consumption trends and factors affecting resource use. Depletion and management of natural resource. Sustainable development. Policy and governance.
Module-2	Water Resource: Introduction. Hydrological cycles. Major sources of water. Use and depletion of water resources. State of water resources of Nepal. Water resource management.
Module-3	Land resource: Concept of land resource. Land use. Land resource degradation. Land resource management (Policy, planning and practice).
Module-4	Mineral resource: Introduction, types and importance of mineral resource. Consequence of mineral extraction, Status of major minerals in Nepal. Conservation of mineral resources. Mountain Resource: Mountain natural resource and their conservation
Module-5	Biodiversity Resource: Introduction, types and importance of biological resources. Concept of biodiversity. State and threats of biodiversity of Nepal. Management of biodiversity (ex-situ and in-situ)

Recommended Books

1	"Ecology" by Robert E. Ricklefs
2	"Evolution" by Mark Ridley
3	"Conservation Biology" by Gary K. Meffe
4	"Animal Behavior" by James L. Gould

Course Name-Zoology III

Course Code-BCBZ313

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

Course Outcomes (COs)

CO 1	Discuss the principles of animal ecology, including ecosystem dynamics and conservation biology.
CO 2	Describe the concepts of animal biotechnology, including genetic engineering and gene cloning.
CO 3	Understand the applications of biotechnology in animal health and production.
CO 4	Analyze data and interpret results from study

Course Outline (CO)	
1	Unit-1/ Definition /5 Hours Per Week
2	Unit-2/Aquaculture and Sericulture/ 6 Hours Per Week
3	Unit-3/Structure of silk gland and secretion of silk / 7 Hours Per Week
4	Unit-4/Apiculture and Vermiculture/ 7 Hours Per Week
5	Unit-5/Introduction of Vermiculture and Vermicomposting. /6 Hours Per Week
Detailed Syllabus	
Module-1	Aquaculture and Sericulture: Types of Fisheries; Fresh Water Fish and Prawn culture Fresh water fishing gears and crafts; Induced Breeding, Hatchery design and Management of fish and prawn; Transportation of fish and prawn seed. Preservation, Processing and By-products of fishes, Fish Diseases and control measures Life cycle of Bombyxmori
Module-2	Structure of silk gland and secretion of silk, Silkworm rearing technology., Spinning, harvesting and storage of cocoons, Silk worm Pests and Diseases: Uzi fly; Protozoan, Viral, Fungal and Bacterial; Control and prevention, Prospects of Sericulture in India
Module-3	Apiculture and Vermiculture: Selection of Bee Species for Apiculture., Bee Keeping Equipment, Methods of Extraction of Honey (Indigenous and Modern)., Bee Diseases and Enemies, Products of Apiculture Industry and its Uses (Honey, Bees Wax)
Module-4	Introduction of Vermiculture and Vermicomposting: Vermiculture techniques, Bedding, Essential parameters for Vermiculture and Management, Methods of Harvesting (Manual & Mechanical), Economic Importance of Vermiculture.
Module-5	Poultry Farming & Animal Husbandry: Classification of Fowls based on their use – Broilers and Commercial layers, Principles of poultry breeding, Management of breeding stock and broilers, Processing and preservation of eggs. Poultry diseases - Viral, Bacterial, Fungal, Protozoan Management of a modern Poultry Farm, progressive plans to promote Poultry as a Self-Employment venture, Dairy farm and its management Animal Husbandry – Introduction, Preservation of semen, artificial insemination of cattle, Induction of early puberty and synchronization of estrus in cattle
Recommended Books	
1	"Animal Ecology" by M. Begon
2	"Biotechnology" by J. E. Smith
3	"Animal Biotechnology" by D. M. Glover

UNIVERSITY OF TECHNOLOGY, JAIPUR

Syllabus

3rd Year B.Sc. (CBZ) - July-2022)

Chemistry Lab [BCBZ 352]

Credit1
0L+0T+2P

Max.Marks:100 (IA:60,ETE:40)

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 conductometrically
2. To study the saponification of ethyl acetate conductometrically
3. To study the strength of the give acid conductometrically using standard alkali solution

UNIVERSITY OF TECHNOLOGY, JAIPUR

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

Botany Lab [BCBZ 353]

Credit1
0L+0T+2P

Max.Marks:100 (IA:60,ETE:40)

Plant Identification
- Morphology and anatomy of flowering plants
- Identification of local flora
- Study of plant families (Fabaceae, Solanaceae, etc.)
Microscopy and Histology
- Microscopy techniques
- Plant tissue preparation and staining
- Histology of plant tissues (root, stem, leaf)
Plant Tissue Culture and Propagation
- Techniques of plant tissue culture
- Propagation of plants using seeds and vegetative methods
- Study of plant growth regulators
Cytology and Genetics
-Chromosome preparation and analysis
- Genetic experiments (Monohybrid, Dihybrid, etc.)
- Study of genetic mutations

UNIVERSITY OF TECHNOLOGY, JAIPUR

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

Zoology Lab [BCBZ 354]

Credit1
0L+0T+2P

Max.Marks:100 (IA:60,ETE:40)

1. Plant Identification
- Morphology and anatomy of flowering plants
- Identification of local flora
2. Microscopy and Histology
- Microscopy techniques
- Plant tissue preparation and staining
- Histology of plant tissues
3. Plant Tissue Culture and Propagation
- Techniques of plant tissue culture
- Propagation of plants using seeds and vegetative methods
4. Cytology and Genetics
- Chromosome preparation and analysis
- Genetic experiments