Indrashil University

Department of Chemistry
School of Science

B.Sc. 2025-2029
Sem I-II

Chemistry

Course Profile

Academic Year 2025-2026

B.Sc. Chemistry Semester I
Course Structure

Course Code	Course Name	Course Type	L-T-P	Credits
CH1 101	Organic Chemistry-I: Basic Organic Chemistry	Major Discipline Core **(MDC)**	2-0-0	2
CH1 102	Inorganic Chemistry-I: Basic Inorganic Chemistry		2-0-0	2
CH1 103	Organic Chemistry -I Laboratory		0-0-4	2
CH1 104	Inorganic Chemistry-I Laboratory		0-0-4	2
CH1 105	Basic Physics	Minor Discipline Elective (**MDE**)	2-0-0	2
CH1 106	Basic Physics Laboratory		0-0-4	2
CH1 107	Chemistry in Daily Life	Multi-Disciplinary **(MDS)**	2-0-0	2
CH1 108	Chemistry in Daily Life Laboratory		0-0-4	2
CH1 109	Communication Skill-I	Ability Enhancement Course **(AEC)**	2-0-0	2
CH1 110	Computer Skills in Chemistry	Skill Enhancement Course **(SEC)**	2-0-0	2
CH1 111	Yoga for Wellness	Value Added Course **(VAC)/** Indian Knowledge System **(IKS)**	2-0-0	2
Total			**14L+0T+ 16P = 30 hrs.**	**22**

B.Sc. Chemistry Semester II
Course Structure

Course Code	Course Name	Course Type	L-T-P	Credits
CH1 201	Organic Chemistry-II: Chemistry of Oxygenated Hydrocarbons	Major Discipline Core (**MDC**)	2-0-0	2
CH1 202	Physical Chemistry-I: States of Matter		2-0-0	2
CH1 203	Organic Chemistry - II Laboratory		0-0-4	2
CH1 204	Physical Chemistry – I Laboratory		0-0-4	2
CH1 205	Physics of Semiconductor Devices	Minor Discipline Elective (**MDE**)	2-0-0	2
CH1 206	Physics of Semiconductor Devices Laboratory		0-0-4	2
CH1 207	Chemistry of Materials	Multi-Disciplinary (**MDS**)	2-0-0	2
CH1 208	Chemistry of Materials Laboratory		0-0-4	2
CH1 209	Communication Skill-II	Ability Enhancement Course (**AEC**)	2-0-0	2
CH1 210	Techniques of Chemical Analysis	Skill Enhancement Course (**SEC**)	2-0-0	2
CH1 211	Health and Nutrition	Value Added Course (VAC)/ Indian Knowledge System (**IKS**)	2-0-0	2
Total			**14L+0T+ 16P = 30 hrs.**	**22**

B.Sc. Chemistry Semester I

CH1 101: Organic Chemistry-I: Basic Organic Chemistry (L-T-P-C: 2-0-0-2)

Program: B. Sc. Chemistry	**Semester:** I
Course Code: CH1 101	**Course Name:** Organic Chemistry-I: Basic Organic Chemistry

Lecture (Hours)	Practical (Hours)	Credits	Total Hours	Evaluation Scheme			
				Component	Exam	Max. Marks	Passing %
2 per week	-	2	30	Lecture	CCE, ESE	50	40

Course Objectives:

- Basics of organic compound nomenclature and hybridization
- Learning electronic effects: inductive, resonance, hyperconjugation
- Knowledge about reactive intermediates: carbocations, carbanions, free radicals

Course Learning Outcomes: At the end of this course, students will be able to
CLO1: Remember the concept of hybridisation, electronic displacement, the CIP rule of organic compounds and the name reaction
CLO2: Explain the physical and chemical properties of alkene, alkane and alkyne
CLO3: Discuss the name reactions such as the Wurtz Reaction, Wurtz-Fittig reaction
CLO4: Implement the knowledge of electronic displacement and geometrical isomerism

Syllabus

Units	Content	Hours
Unit I: Organic Compounds	Classification, and Nomenclature. Hybridization, Shapes of molecules Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation, Homolytic and Heterolytic fission with suitable examples. Electrophiles and Nucleophiles Reactive intermediates: Carbocations, carbanions, and free radicals.	**10**
Unit II: Stereochemistry	**Geometrical isomerism**: Fischer Projection, D/L nomenclature, Newmann and Sawhorse Projection formulae and their interconversions; Geometrical isomerism: cis–trans and, syn-anti isomerism E/Z notations. **Optical Isomerism:** Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Diastereoisomers, Racemic mixture and resolution, meso compounds. Relative and absolute configuration: nomenclature of chiral compounds, C.I.P rules, and R/S notations.	**10**
Unit III: Aliphatic Hydrocarbons	**Alkanes**: General methods of preparation, physical and chemical properties of alkanes: Wurtz Reaction, Wurtz-Fittig Reaction, Free radical substitutions: Halogenation - relative reactivity and selectivity. Applications of hydrocarbons **Alkenes and Alkynes:** General methods of preparation, physical and chemical properties of alkenes and alkynes, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann elimination reaction. Electrophilic addition reactions with their mechanisms, oxidation reactions, the reaction of oxymercuration-demarcuration, hydroboration-oxidation, reduction, 1,2-and 1,4-addition reactions of conjugated enones; Allylic and benzylic bromination with suitable examples. Reactions of alkynes: Electrophilic and Nucleophilic additions. Oxidation and alkylation reactions of terminal alkynes.	**10**

Reading References:

1. R. T. Morrison; R. N. Boyd. *Organic Chemistry.* Dorling Kindersley (India) Pvt. Ltd., Pearson Education, New Delhi. 2010, 7th Ed.
2. I. L. Finar. *Organic Chemistry (Volume 1).* Dorling Kindersley (India) Pvt. Ltd., Pearson Education, New Delhi. 2002, 6th Ed.
3. I. L. Finar. *Organic Chemistry (Volume 2: Stereochemistry and the Chemistry of Natural Products).* Dorling Kindersley (India) Pvt. Ltd., Pearson Education, New Delhi. 2002, 5th Ed.
4. E. L. Eliel; S. H. Wilen. *Stereochemistry of Organic Compounds.* Wiley, London. 1994, 1st Ed.
5. S. M. Mukherji; S. P. Singh; R. K. Kapoor. *Organic Chemistry, Volume 1.* Narosa Publishing House, New Delhi. 2017, 1st Ed.
6. A. Bahl; B. S. Bahl. *A Textbook of Organic Chemistry.* S. Chand Publications, New Delhi. 2019, 22nd Ed.
7. R. L. Madan. *Chemistry for Degree Students.* S. Chand Publications, New Delhi. 2016, 1st Ed.

CH1 102: Inorganic Chemistry-I: Basic Inorganic Chemistry-I: (L-T-P-C: 2-0-0-2)

Program: B. Sc. Chemistry	**Semester:** I
Course code: CH1 102	**Course name:** Inorganic Chemistry-I: Basic Inorganic Chemistry

Lecture (Hours)	Practical (Hours)	Credits	Total Hours	Evaluation Scheme			
				Component	Exam	Max. Marks	Passing %
2 per week	-	2	30	Lecture	CCE, ESE	50	40

Course Objectives:

- Understanding atomic structure with different models, and the line- spectrum of hydrogen atoms.
- This course explains different principles of filling the electrons in different orbitals.
- This course also delivers the idea about acids and bases with HSAB principle.

Course Learning Outcomes: At the end of this course students will be able to
CLO1: Describe the different models of the structure of the atom.
CLO2: Explain the concept of quantum numbers, orbit, and orbital
CLO3: Classify the line spectrum of the Hydrogen atom.
CLO4: Illustrate the concept of acids and bases and the usefulness of the HSAB Principle.

Syllabus

Units	Content	Hours
Unit I: Atomic Structure Models	**Atomic Structure**: Structure of atom, Rutherford Model, alpha-scattering experiments, and its defects, Bohr's model of the atom, radii, and Energy of an electron in Bohr orbit, the atomic spectrum/ line spectrum of the hydrogen atom, Rydberg equation and concept of Rydberg constant, Bohr's theory of H-spectra. Shapes of s, p, d, and f orbitals. limitations of Bohr's theory.	**10**
Unit II: Quantum Numbers and the Concept of Orbital	Quantum numbers and their significance, the concept of orbit and orbital, quantum numbers and orbitals relation, the spatial orientation of atomic orbital, shape of the orbital, ordering of orbital in multi-electron atoms, Pauli's Exclusion Principle, Hund's rule and orbital filling, Aufbau's principle and its limitations, Variation of orbital energy with atomic number, (n+l) rule.	**10**
Unit II: Acid-Base concepts, HSAB principle	**Concept of Acids & Bases**: Modern theory of acids and bases: The Arrhenius concept, The protonic concept (Bronsted-Lowry concept), The electronic concept (Lewis's theory), and their demerits. Acid-Base adduct & Gutmann's rule. Hard and soft acids-bases principle (HSAB principle), concept of Hard Acids, Hard Bases, Soft Acids, Soft Bases, usefulness of HSAB principle, relative strength of Acids & Bases and effects of substituents and solvents on acidity and basicity, leveling effect of water. Strength of oxo and hydra acids, pH, K_W and, pka, super acids.	**10**

References Material:

1. J. D. Lee. *Concise Inorganic Chemistry.* Blackwell Science, Oxford. 2008, 5th Ed.
2. R. P. Sarkar. *General and Inorganic Chemistry, Vol. I & II.* New Central Book Agency, Kolkata. 2012, 1st Ed.
3. F. A. Cotton; G. Wilkinson; Paul L. Gaus. *Basic Inorganic Chemistry.* Wiley, New York. 2007, 3rd Ed.
4. R. L. Madan. *Chemistry for Degree Students.* S. Chand and Company Ltd., New Delhi. 2010, 2nd Ed.

CH1 103: Organic Chemistry-I Laboratory (L-T-P-C: 0-0-4-2)

Program: B. Sc. Chemistry	**Semester:** I
Course code: CH1 103	**Course name:** Organic Chemistry-I Laboratory:

Lecture (Hours)	Practical (Hours)	Credits	Total Hours	Evaluation Scheme			
				Component	Exam	Max. Marks	Passing %
--	2 per week	2	60	Lab	CCE, ESE	50	40

Course Objectives:

- Introduces basic practical techniques in organic chemistry.
- Covers purification and crystallisation of organic compounds.
- Includes melting point determination for purity analysis.
- Focuses on the identification and separation of organic mixtures.
- Involves the synthesis of simple compounds like acetanilide and *m*-nitrobenzoic acid.
- Emphasises skill development in observation and analysis.

Course Learning Outcomes: At the end of this course students will be able to
CLO1: Identify the suitable methods for the separation of organic mixtures.
CLO2: Understand the separation techniques and molecular chirality of organic molecules
CLO3: Demonstrate the preparation of acetanilide and m-nitrobenzoic acid.
CLO4: Connect the preparation of an organic compound and the separation technique

Syllabus

Sr. No.	Name of the Experiment	Hours
1	To determine the melting points of given organic compounds a melting point apparatus	**6**
2	To purify a volatile compound from a mixture of components by distillation	**6**
3	To visualize the molecular chirality in the organic chemistry laboratory	**6**
4	To select suitable solvents for the purification/crystallization of organic compounds	**6**
5	To identify and separate the components in a given mixture of 2-amino acids (glycine, aspartic acid, glutamic acid, tyrosine, or any other amino acid) by paper chromatography.	**6**
6	To identify and separate the sugars present in the given mixture by paper chromatography	**6**
7	To prepare acetanilide from aniline using Zn/acetic acid (Green method)	**12**
8	To synthesize *p*-nitro acetanilide from acetanilide using a nitrating mixture	**12**

Reading Materials:

1. B. S. Furniss. *Vogel's Textbook of Practical Organic Chemistry.* Pearson Education, New Delhi. 2011, 5th Ed.
2. Arthur I. Vogel. *Practical Organic Chemistry.* Pearson Education Limited, London. 1995, 5th Ed.
3. A. K. Nad; B. Mahapatra; A. Ghoshal. *An Advanced Course in Practical Chemistry.* New Central Book Agency, Kolkata. 2022, 3rd Ed.
4. V. K. Ahluwalia; Sunita Dhingra. *Practical Organic Chemistry.* New Central Book Agency, Kolkata. 2017, 1st Ed.
5. N. K. Vishnoi. *Advanced Practical Organic Chemistry.* Vikas Publishing House, New Delhi. 2009, 3rd Ed.

CH1 104: Inorganic Chemistry-I Laboratory (L-T-P-C: 0-0-4-2)

Program: B. Sc. Chemistry	**Semester:** I
Course code: CH1 104	**Course name:** Inorganic Chemistry-I Laboratory

Lecture (Hours)	Practical (Hours)	Credits	Total Hours	Evaluation Scheme			
				Component	Exam	Max. Marks	Passing %
--	4 per week	2	60	Lab	CCE, ESE	50	40

Course Objectives:

- Develop essential laboratory skills in volumetric analysis**,** including precise measurement, titration, and data interpretation.
- Determine the molar concentration of a base through acid-base titration using a standard acid solution.
- Gain hands-on experience in measuring the pH of unknown acid and base solutions using a pH meter
- Learn to prepare solutions of various molarities and normalities accurately for use in titrations and other chemical analyses.

Course learning outcome: At the end of this course, the students will learn to
CLO 1: Describe the concentration of solutions in normality, molarity, and percentage-wise wise
CLO 2: Discuss the determination of the acidity/basicity of different chemicals
CLO 3: Classify the relative strength of acids and bases
CLO 4: Analyze the relation between acidity and basicity with pH

Syllabus

Sr. No.	Name of the Experiment	Hours
1	To perform titrimetric analysis: Calibration of unknown solutions.	**10**
2	To prepare solutions with different molarity/normality of titrants	**6**
3	To determine the density of unknown inorganic samples.	**6**
4	To determine the pH of unknown acids and bases with the help of a pH meter.	**6**
5	To determine polyprotic acid pKas: Titrate H_3PO_4 with NaOH; identify three inflection points or use a derivative plot.	**6**
6	To estimation the strength of oxalic acid by titrating it with $KMnO_4$ solution	**6**
7	To determine the molar concentration of a base from the known concentration of an acid.	**10**
8	To analyze HSAB Preference via Competition Reactions.	**10**

Reference Materials:

1. G. H. Jeffery; J. Bassett; J. Mendham; R. C. Denney. *Vogel's Textbook of Quantitative Chemical Analysis.* Orient Longman, New Delhi. 1989, 5th Ed.
2. G. Svehla. *Vogel's Textbook of Macro and Semimicro Qualitative Inorganic Analysis.* Orient Longman, New Delhi. 1982, 5th Ed.
3. Mala Nath. *Inorganic Chemistry: A Laboratory Manual.* Alpha Science International Ltd., Oxford. 2016, 1st Ed.

CH1 105: Basic Physics (L-T-P-C: 2-0-0-2)

Program: B. Sc. Chemistry	**Semester:** I
Course code: CH1 105	**Course name:** Basic Physics

Lecture (Hours)	Practical (Hours)	Credits	Total Hours	Evaluation Scheme			
				Component	Exam	Max. Marks	Passing %
2 per week	--	2	30	Lecture	CCE, ESE	50	40

Course objectives:

- The fundamentals of basic measurement of various units, their accuracy and finding the error of any instrument which can help for the dimensional analysis.
- The basics of vector analysis for two and three vectors and their physical significance.
- The concept of crystal structure of a solid material which will be useful to study the periodic systems.
- The fundamental properties of a crystal will be discussed and the technique which can help to identify the crystal structure will also be discussed.

Course Learning Outcome: At the end of this course students will be able to
CLO1: Remember the basic concept of error analysis and vector algebra.
CLO2: Understand the basics of the crystal structure of solids.
CLO3: Solve the problems related to vector analysis using vector algebra with real-life examples.
CLO4: Analyze the concepts of different types of crystal structures and able to demonstrate them

Syllabus

Units	Content	Hours
Unit I: Dimension and Error Analysis	The international system of units, Measurement of length, Measurement of mass, Measurement of time, Accuracy, precision of instruments and errors in measurement, Significant figures, Dimensions of physical quantities, Dimensional formulae and dimensional equations, Dimensional analysis and its applications	**10**
Unit II: Vector Analysis	Introduction to Scalar and Vectors, Dot and Cross Products, Triple Products and Its Physical Interpretation, ∇ Operator, Vector Operations: Gradient, Divergence and Curl, Their Physical Interpretation,	**10**
Unit III: Crystal Lattice and Properties	Types of solids, differences between crystalline and amorphous solids. Types of crystal, space lattice and unit cell of a crystal, different types of unit cells, lattice parameters, Bravais lattice in 2D and 3D, interplanar spacing, simple crystal structure, symmetry operations, Close – Packed Structure, Loose – Packed Structure, Types of Lattices structures of sodium chloride, cesium chloride, zinc blende, packing of crystals, radius ratio rules, Miller indices, X-ray Diffraction, Bragg's law, X-ray Diffraction methods: Laue method, Rotating Crystal Method, Powder Method, Reciprocal Lattice, properties of reciprocal lattice, Illustrative examples.	**10**

Reference Materials:

1. R. K. Gaur; S. L. Gupta. *Engineering Physics.* Dhanpat Rai Publications, New Delhi. 2006, Revised Ed.
2. R. K. Puri; V. K. Babbar. *Solid State Physics.* S. Chand Publications, New Delhi. 2007, 1st Ed.
3. Charles Kittel. *Introduction to Solid State Physics.* John Wiley & Sons, New York. 2006, 8th Ed.
4. David Halliday; Robert Resnick; Jearl Walker. *Fundamentals of Physics (Extended Version).* Wiley, New York. 2010, 10th Ed.

CH1 106: Basic Physics Laboratory (L-T-P-C: 0-0-4-2)

Program: B. Sc. Chemistry	**Semester:** I
Course code: CH1 106	**Course name:** Basic Physics Laboratory

Lecture (Hours)	Practical (Hours)	Credits	Total Hours	Evaluation Scheme			
				Component	Exam	Max. Marks	Passing %
--	4 per week	2	60	Lecture	CCE, ESE	50	40

Course objectives: students will learn

- The fundamentals of basic measuring instruments such as Vernier Callipers, Screw gauge, etc.
- The basics of different electronic devices such as transformer, solenoid, etc.
- They will understand the concept and importance of inertia, elasticity, etc. which can help them to use the concept in their real-life applications.

Course Learning Outcome: At the end of this course, students will be able to
CLO1: Record the determination of physical properties.
CLO2: Estimate the crystal structure of solids.
CLO3: Calculate different physical properties like the density of the sample object.
CLO4: Operate the equipment using Newton's ring and the Thomson method.

Syllabus

Sr. No.	Name of the Experiment	Hours
1	To study the vernier caliper's principle and to learn the use of vernier calipers for the accurate measurement of length.	**6**
2	To become familiar with the screw gauge and spherometer and learn the use of it for accurate measurements of small lengths	**6**
3	Determining the value of specific charge e/m of an electron by Thomson's method.	**10**
4	To study a Transformer to determine its 1. Transformation Ratio 2. Percentage Efficiency 3. Copper losses	**10**
5	a) To study the magnetic field of produced by a current carrying solenoid using a search coil. b) Find the value of permeability μ0 for air.	**10**
6	To find out the Moment of Inertia of a Flywheel	**8**
7	To determine the Young's modulus of the material of a beam by method of Bending of Beam.	**10**

Reference Materials:

1. C. L. Arora. *B.Sc. Practical Physics.* S. Chand & Company, New Delhi. 2010, Revised Ed.
2. Harnam Singh; P. S. Hemne. *B.Sc. Practical Physics.* S. Chand Publications, New Delhi. 2000, 1st Ed.

CH1 107: Chemistry in Daily Life (L-T-P-C: 2-0-0-2)

Program: B. Sc. Chemistry	**Semester:** I
Course Code: CH1 107	**Course Name:** Chemistry in Daily Life

Lecture (Hours)	Practical (Hours)	Credits	Total Hours	Evaluation Scheme			
				Component	Exam	Max. Marks	Passing %
2 per week	--	2	30	Lecture	CCE, ESE	50	40

Course Objectives:

- To enlighten students about the practical use of chemistry in daily life.
- To make students learn how chemistry is involved in daily food products and how food quality can be ensured using Chemistry knowledge.
- To make students aware about applications of chemistry in synthesis of soaps, detergent, fertilizer, pesticides and other daily products.

Course Learning Outcome: At the end of this course students will be able to
CLO1: Chemical composition of Dairy products.
CLO2: Chemical composition of different Food additives.
CLO3: Chemistry behind soaps, detergents and agro-products
CLO4: Applications of Chemistry in Electronic devices.

Syllabus

Units	Contents	Hours
Unit I: Food Chemistry	**Dairy Products:** Composition of milk and milk products. Analysis of major/minor components, Estimation of added water in milk. Compare milk from different sources. Milk adulteration.	**10**
Unit II: Additives and Nutrients	**Food additives, adulterants, and contaminants.** Introduction and history of food preservatives, classification of food preservatives, and real-life examples of food preservatives. **Sweetening agents**: Introduction, classification of sweetening agents, and some examples of sweetening agents. **Flavors:** Introduction, Vanillin, alkyl esters (fruit flavors), and monosodium glutamate. Curcumins. **Vitamins:** Introduction, Classification and Nomenclature. Sources, deficiency diseases, and structures of Vitamin A1, Vitamin B1, Vitamin C, Vitamin D, Vitamin E & Vitamin K1. Comparison of vitamins from food and pills.	**10**

Unit III: Cosmetics and Pesticides	**Soap and Detergents:** Introduction and History of soap synthesis, manufacturing of soaps and detergents, compositions, and uses. **Chemistry of Cosmetics:** A general study including preparation and uses of the following: Hair dye, hair spray, shampoo, suntan lotions, face powder, lipsticks, talcum powder, nail enamel, creams, antiperspirants, and artificial flavors. **Chemistry of Pesticides:** General introduction to pesticides (natural and synthetic), benefits and adverse effects, uses of representative pesticides in the following classes: Organochlorines (DDT, gammaxene); Organophosphates (malathion, parathion); Carbamates (carbofuran and carbaryl); Hazards associated with the synthesis and use of pesticides. **Electronic Materials in Daily life:** Chemistry in synthesis of cells and batteries, Types of Batteries, Applications of batteries in mobile, laptop and daily electronic devices Liquid crytals and its application in designing LCDs of television.	**10**

Reading References:

1. B. K. Sharma. *Introduction to Industrial Chemistry.* Goel Publishing House, Meerut. 1998, 1st Ed.
2. Ashutosh Kar. *Medicinal Chemistry.* New Age International Publishers, New Delhi. 2010, 1st Ed.
3. Fred W. Billmeyer. *Textbook of Polymer Science.* Wiley, New York. 1984, 3rd Ed.
4. N. Shakuntala Manay; M. Shadaksharaswamy. *Foods: Facts and Principles.* New Age International Publishers, New Delhi. 1998, 4th Ed.
5. M. S. Swaminathan; S. K. Goswami. *Handbook on Fertilizer Technology.* Fertilizer Association of India, New Delhi. 2001, 6th Ed.

CH1 108: Chemistry in Daily Life Laboratory (L-T-P-C: 0-0-4-2)

Program: B. Sc. Chemistry	**Semester:** I
Course code: CH1 108	**Course name:** Chemistry in Daily Life Laboratory

Lecture (Hours)	Practical (Hours)	Credits	Total Hours	Evaluation Scheme			
				Component	Exam	Max. Marks	Passing %
--	4 per week	2	60	Practical	CCE, ESE	50	40

Course Objectives:

- To serve as a lab guide for understanding daily chemistry applications like synthesis of some daily used products and their characterization.
- Understand synthesis and identification of organic molecules using different synthetic protocol.
- To identify and quantify different chemicals in food products like determination of the amount of caffeine into their sources.

Course Learning Outcome: At the end of this course students will be able to
CLO1: Synthesis of soap and detergent and characterization using suitable methods.
CLO2: Utilizing suitable methods for the synthesis of organic molecules.
CLO3: Calculate the degree of unsaturation in the addible fats.
CLO4: Estimate the caffeine content in the tea and coffee using suitable method

Syllabus

Sr. No.	Name of the Experiment	Hours
1	To prepare and characterize soaps	**8**
2	To prepare and characterize detergents	**8**
3	To synthesize aspirin from salicylic acid	**8**
4	To detect aldehyde using Fehling's test	**8**
5	To test unsaturation in ghee and oil using Bromine water	**8**
6	To analyze caffeine content in tea and coffee samples	**10**
7	To identify cottonseed oil by Halphen's Test	**10**

Reading References:

1. Elias Anil J. *A Collection of Interesting General Chemistry Experiments.* University Press, Hyderabad. 2012, 1st Ed.

CH1 109: Communication Skills-I (L-T-P-C: 2-0-0-2)

Program: B. Sc. Chemistry	**Semester:** I
Course code: CH1 109	Course name: Communication Skills-I

Lecture (Hours)	Practical (Hours)	Credits	Total Hours	Evaluation Scheme			
				Component	Exam	Max. Marks	Passing %
4 per week	--	2	30	Lecture	CCE, ESE	50	40

Course Objectives:
Course Learning Outcomes: At the end of this course the students will be able to
CLO1: Know the rules of grammar and sentence making
CLO2: Explain verbal communications and instructions, when done in English
CLO3: Paraphrase sentence framing and writing
CLO4: Classify the difficulty in English communications

Syllabus

Units	Content	Hours
Unit I: Effective Communication in the Digital Age	**Communication Skills**: Importance of communication skills, communication cycle, types, flows, barriers, nonverbal communication, Formal vs. Informal communication, Digital communication basics (email, chat, video calls) **Listening skills:** Types of listening, barriers to effective listening, tips to improve listening Skills, Active listening and note-taking	**15**
Unit II: Communicative English: Grammar to Group Talk	**Grammar**: Articles, prepositions, tenses, concord, adjectives & degrees of comparison, adverbs, Common grammatical errors and corrections **Speaking Skills**: Impromptu, short situational dialogues/conversation, short speeches, presentations, Debate and group discussion practice, Role plays based on real-life scenarios **Reading Skills**: Difference between skimming & scanning, identifying main idea and topic, guessing the meanings of words	**15**

Reading References:

1. Dr. Sanjay Kumar; Dr. Pushp Lata. *Communication Skills.* Oxford University Press, New Delhi. 2011, 2nd Ed.
2. Meenakshi Raman; Sangeeta Sharma. *Technical Communication: Principles and Practice.* Oxford University Press, New Delhi. 2015, 3rd Ed.
3. M. Ashraf Rizvi. *Effective Technical Communication.* McGraw Hill Education, New Delhi. 2017, 2nd Ed.
4. Vitthal Patel; Unnat Patel. *Textbook of Communication Skills.* Ria Publishing House, Ahmedabad. 2013, 1st Ed.
5. Wren & Martin. *Key to High School English Grammar and Composition.* S. Chand Publishing, New Delhi. 2017, Revised Ed.

CH1 110: Computer Skills in Chemistry (L-T-P-C: 2-0-0-2)

Program: B. Sc. Chemistry	**Semester:** I
Course code: CH1 110	**Course name:** Computer Skills in Chemistry

Lecture (Hours)	Practical (Hours)	Credits	Total Hours	Evaluation Scheme			
				Component	Exam	Max. Marks	Passing %
2 per week	--	2	30	Lecture	CCE, ESE	50	40

Course Objectives:

- The basics of computer skills such as concept of hardware, software, etc.
- The fundamentals of different types of number systems which help them to understand the binary numbers which are essential for a computer system.
- The basics and working of different types of data storage devices which helps for day-to-day work.
- The basic operations such as MS Office for the better data analysis, graph interpretation in the chemistry.

Course Learning Outcomes: At the end of this course, students will be able to
CLO1: Remember the basics of computer software and hardware.
CLO2: Understand the mutual conversion between the different number systems.
CLO3: Describe different types of devices such as pointing devices and scanning devices
CLO4: Analyze the use of memory devices in real life.

Syllabus

Units	Content	Hours
Unit I: Introduction to Computers	Computer system: characteristics and capabilities. Computer Hardware and Software: Block Diagram of a Computer, Data Processing System, Storing Data, Processing Data. Types of Computers, Generation of Computers.	**10**
Unit II: Computer Peripherals	Storage Introduction to Input Devices: Categorizing Input Hardware, Keyboard, Direct Entry — Card Readers, Scanning Devices — O.M.R., Character Readers, Thumb Scanner, MICR, Smart Cards, Voice Input Devices, Pointing Devices	**10**
Unit III: Basic Components and Storage Device	Central Processing Unit: The Microprocessor, control unit, Buses, Main Memory, Main Memory (RAM) for microcomputers, Read Only Memory (ROM). Storage Devices: Storage Fundamentals, Primary and Secondary Storage, Hard Disks, Disk Cartridges, Optical Disks, CD ROM. Binary, Octal, Decimal and Hexadecimal number system and their mutual conversions, Illustrative examples.	**10**

Reading References:

1. P. K. Sinha. *Computer Fundamentals.* BPB Publications, New Delhi. 2012, 6th Ed.
2. V. Rajaraman. *Introduction to Information Technology.* PHI Learning Pvt. Ltd., New Delhi. 2008, 2nd Ed.
3. Suresh K. Basandra. *Computers Today.* Galgotia Publications, New Delhi. 2018, Revised Ed.
4. Peter Norton. *Computing Fundamentals.* McGraw Hill-Osborne, New York. 2010, 6th Ed.

CH1 111: Yoga for Wellness (L-T-P-C: 2-0-0-2)

Program: B. Sc. Chemistry	**Semester:** I
Course code: CH1 111	**Course name:** Yoga for Wellness

Lecture (Hours)	Practical (Hours)	Credits	Total Hours	Evaluation Scheme			
				Component	Exam	Max. Marks	Passing %
1 per week	2 per week	2	45	Lecture, Lab	CEE, ESE	50	40

Course Objectives:

- This course deals with an understanding of mind and body through various types of physical postures, commonly known as Asanas.
- This course also teaches techniques of meditation, and breathing to keep a balance in everyone's daily life and maintain physical and mental health, flexibility, and endurance.

Course learning outcome: Through this course, the students will be able to
CLO1: Define the basic skills associated with yoga activities
CLO2: Discuss the ability to perform yoga movements in various combinations and forms.
CLO3: Understand the theoretical parts of yoga
CLO4: Apply yoga activities to citizens for their wellness

Syllabus

Units	Content	Hours
Unit I	Different terminologies and meaning of yoga, types of yoga, illusions of yoga, benefits of yoga. Details about Ashtanga Yoga, and it's types. Understanding of complementary asanas with examples. Pranayama, types and it's forms, benefits of pranayama. Understanding of Pratyahar and examples.	**15**
Unit II	Practicing Suryanamaskar, Padmasana, Gomukhasan, Dhanurasan, Tadasan, Padahastasan, Bhadrasan, Shavasan, Utthanpadasan, Purnatitli asan.	**15**
Unit III	Health meaning of health, Definition, Health Education, policy, Effect of health health spectrum, physical health, social health, Mental health, Health test program	**15**

Reading References:

1. Swami Vivekananda. *Complete Book of Yoga: Karma Yoga, Bhakti Yoga, Raja Yoga, Jnana Yoga.* Arushi Book Enterprises, New Delhi. 2023, 1st Ed.

B.Sc. Chemistry Semester II

CH1 201: Organic Chemistry-II: Chemistry of Oxygenated Hydrocarbons (L-T-P-C: 2-0-0-2)

Program: B. Sc. Chemistry	**Semester:** II
Course code: CH1 201	**Course name:** Organic Chemistry-II: Chemistry of Halogenated and Oxygenated Hydrocarbons

Lecture (Hours)	Practical (Hours)	Credits	Total Hours	Evaluation Scheme			
				Component	Exam	Max. Marks	Passing %
2 per week	--	2	30	Lecture, Lab	CEE, ESE	50	20

Course Objective:

- Course provides a clear understanding of the chemistry of alkyl and aryl halides, along with oxygenated hydrocarbons.
- To focuses on their preparation methods, physical and chemical properties, and overall reactivity.
- Students will learn the mechanisms of important named reactions associated with these classes of compounds.
- Course introduces the use and significance of basic reagents such as lithium aluminium hydride ($LiAlH_4$) and sodium
- borohydride ($NaBH_4$)
- Course also offers insight into the concept of aromaticity through the application of Hückel's rule.

Course Learning Outcomes: At the end of this course, students will be able to
CLO1: Remember the preparation and related name reaction of oxygenated, alky, and aryl halide compounds
CLO2: Understand the difference between substitution and elimination reactions.
CLO3: Applying the knowledge in multi-step synthesis.
CLO4: Explaining the reaction mechanism and reactivity of oxygenated, alkyl, and aryl halide compounds

Syllabus

Unit	Content	Hours
Unit I: Aromaticity	**Aromaticity**: Concept of aromaticity, Hückel's rule, aromatic character of arenes, non-aromaticity, anti-aromaticity, homoaromaticity, Aromaticity in Heterocycles, Benzanoid and Non-Benzanoid, Methods to Determine Aromaticity	**05**
Unit II: Alkyl and Aryl Halides	**Alkyl Halides:** Nomenclature and classes of alkyl halides, methods of synthesis and chemical reactions. Different types of nucleophilic substitution reactions and their stereochemistry, SN_1 and SN_2 and SN_i reactions with energy profile diagrams. **Aryl Halides:** Methods of synthesis and chemical reactions of aryl halides, the addition-elimination and the elimination-addition of nucleophilic aromatic substitution reactions. Relative reactivities of alkyl halides, allyl, vinyl and aryl halides.	**10**
Unit III: Chemistry of Oxygenated Hydrocarbons	**Alcohols:** Classification and nomenclature, preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, **Oxidation and Reduction Reaction**: Oxidation of alcohol, oxidation of diols by periodic acid and lead tetraacetate, Bouvaelt Blanc Reaction **Rearrangement**: Pinacol Pinacolone rearrangement **Phenols**: Preparation and properties; Acidity and factors affecting it, Ring substitution reactions, Reimer–Tiemann and Kolbe's–Schmidt Reactions, Fries and Claisen rearrangements with mechanism. **Ethers:**Classification and nomenclature, Preparation and properties: Williamson ether synthesis, Acid and base-catalysed ring opening of epoxides (cyclic ether), orientation of epoxide ring opening, reactions of Grignard and organolithium reagents with epoxides.	**15**

Reading references:

1. S. M. Mukherji; S. P. Singh. *Mechanism and Structure in Organic Chemistry.* New Age International Publishers, New Delhi. 2017, 1st Ed.
2. R. T. Morrison; R. N. Boyd; S. K. Bhattacharjee. *Organic Chemistry.* Pearson Education India, New Delhi. 2010, 7th Ed.
3. L. Finar. *Organic Chemistry (Volume I).* Dorling Kindersley (India) Pvt. Ltd., Pearson Education, New Delhi. 1963, 4th Ed.
4. V. K. Ahluwalia; P. Bhagat; R. Aggarwal; R. Chandra. *Intermediate for Organic Synthesis.* I. K. International Publishing House, New Delhi. 2005, 1st Ed.
5. T. W. Graham Solomons; C. B. Fryhle; S. A. Snyder. *Organic Chemistry.* Wiley, Hoboken. 2016, 12th Ed.
6. R. Chandra; S. Singh; A. Singh. *Organic Reactions and Their Nomenclature.* Arcler Education Inc., New York. 2019, 1st Ed.
7. Bhupinder Mehta; Manju Mehta. *Organic Chemistry.* PHI Learning Pvt. Ltd., New Delhi. 2015, 2nd Ed.

CH1 202: Physical Chemistry-I: States of Matter (L-T-P-C: 2-0-0-2)

Program: B. Sc. Chemistry	**Semester:** II
Course code: CH1 202	**Course name:** Physical Chemistry-I: States of Matter

Lecture (Hours)	Practical (Hours)	Credits	Total Hours	Evaluation Scheme			
				Component	Exam	Max. Marks	Passing %
2 per week	--	2	30	Lecture	CCE, ESE	50	40

Course Objectives:

- Understand the laws and behavior of gases using kinetic and real gas models.
- Explore key liquid properties and their dependence on molecular interactions.
- Learn the structural and physical aspects of solids and crystal systems.

Course Learning Outcomes: At the end of this course students will be able to
CLO1: Describe the correlation of different gas laws and kinetic theory of gas
CLO2: Derive ideal gas equation, Van der Waal's equation and its deviation from ideality

Syllabus

Units	Content	Hours
Unit I: Gas Laws and Real Gas Behavior	**Gaseous State: Derivation of gas laws:** Boyle's law, Charles law, Avogadro's law, Gay-Lussac's law and Dalton's law, Combined gas law or formulation of ideal gas equation, Kinetic theory of gases, formulation of gas laws and concept of P and V from the postulates of Kinetic theory, kinetic gas equation, Maxwell distribution and its use in evaluating molecular velocities (average, root mean square and most probable) and average kinetic energy. Behavior of real gases: Deviations from ideal gas behavior, compressibility factor, *Z*, and its variation with pressure for different gases. Causes of deviation from ideal behavior. van der Waals equation of state, its derivation, and application in explaining real gas behavior, virial equation of state; van der Waals equation expressed in virial form, significance of Van der Waal's constant and calculation their units, concept of Boyle temperature. Amagat's curve for CO_2, N_2, H_2 gases, Isotherms of real gases and their comparison with van der Waals isotherms.	**15**
Unit II: Structure of Solids	**Solid State:** Types of solids, differences between crystalline and amorphous solids. Seven crystal systems and corresponding Bravais lattices. Space lattice and unit cell of a crystal, different types of unit cells (primitive, body centre, face centre), structures of sodium chloride, cesium chloride, zinc blende. Packing of crystals, radius ratio rules, Miller indices, X-ray diffraction and Bragg's law. Defects in crystal (point and line defects) and effects on properties, Application of solid-state chemistry.	**8**
Unit III: Physicochemical Properties of Liquids	**Liquid State:** Intermolecular forces in liquid, vapor pressure, boiling point, surface tension, surface energy, capillary action, viscosity of liquid, Poisseuille's equation. Effect of addition of solutes on properties of liquids. variation on properties of liquids. Optical properties of liquid: refractive index, and Snell's law. Application and real-world relevance.	**7**

Reading References:

1. Dr. R. L. Madan. *Chemistry for Degree Students.* S. Chand Publications, New Delhi. 2022, 1st Ed.
2. B. R. Puri; Madan S. Pathania; L. R. Sharma. *Principles of Physical Chemistry.* Vishal Publishing Co., Jalandhar. 2011, Revised Ed.
3. Gurdeep Raj. *Advanced Physical Chemistry.* Krishna Prakashan Media, Meerut. 2018, 4th Ed.
4. B. R. Puri; L. R. Sharma. *Principles of Physical Chemistry.* Vishal Publishing Co., Jalandhar. 2018, 1st Ed.
5. P. L. Soni. *Textbook of Physical Chemistry.* Sultan Chand & Sons, New Delhi. 2016, Revised Ed.
6. Charles Kittel. *Introduction to Solid State Physics.* John Wiley & Sons, New York. 2018, 8th Ed.
7. C. F. Prutton; H. A. Marron. *Principles of Physical Chemistry.* Oxford & IBH Publishing Co., New Delhi. 2017, 4th Ed.
8. B. R. Puri; L. R. Sharma. *Textbook of Physical Chemistry.* Vishal Publishing Co., Jalandhar. 2020, 1st Ed.
9. K. L. Kapoor. *Textbook of Physical Chemistry.* McGraw Hill Education, New Delhi. 2020, 4th Ed.

CH1 203: Organic Chemistry-II Laboratory (L-T-P-C: 0-0-4-2)

Program: B. Sc. Chemistry	**Semester:** II
Course code: CH1 203	**Course name:** Organic Chemistry-II Laboratory

Lecture (Hours)	Practical (Hours)	Credits	Total Hours	Evaluation Scheme			
				Component	Exam	Max. Marks	Passing %
--	2 per week	2	60	Lab	CCE, ESE	50	40

Course Objectives:

- The practical course in organic chemistry focuses on developing laboratory skills Students will learn to determine the melting points of organic compounds as a means of assessing purity and identification.
- The course also includes solubility tests of organic compounds in various solvents to aid in their characterisation.
- Students will carry out the synthesis of important aromatic compounds, including alkylbenzene, bromobenzene, and nitrobenzene.

Course Learning Outcomes: At the end of this course, students will be able to
CL01: Identify a suitable test for the separation of functional groups
CL02: Understand the alkylation, nitration, and diazotization of organic molecules
CL03: Demonstrate the functional group analysis and related reaction
CL04: Analyze the different functional groups of the given groups

Syllabus

Sr. No.	Name of the Experiment	Hours
1	To perform functional group analysis: characteristic tests for aromatic amine group	**5**
2	To perform functional group analysis: characteristic tests for ketone group	**5**
3	To perform functional group analysis: characteristic tests for phenolic hydroxy group	**10**
4	To perform functional group analysis: characteristic tests for carboxylic acid group	**10**
5	To synthesize alkylbenzene from benzene and alkyl halide in presence of $AlCl_3$.	**10**
6	To prepare nitrobenzene via nitration of benzene.	**10**
7	To synthesize bromobenzene from aniline via diazotization followed by Sandmeyer reaction.	**10**

Reading references:

1. B. S. Furniss. *Vogel's Textbook of Practical Organic Chemistry.* Pearson Education, New Delhi. 2011, Revised Ed.
2. A. I. Vogel; A. R. Tatchell; B. S. Furniss; A. J. Hannaford; P. W. G. Smith. *Textbook of Practical Organic Chemistry.* Prentice-Hall, New Delhi. 1996, 5th Ed.
3. A. K. Nad; B. Mahapatra. *An Advanced Course in Practical Chemistry.* New Central Book Agency, Kolkata. 2022, 3rd Ed.
4. V. K. Ahluwalia; Sunita Dhingra. *Practical Organic Chemistry.* New Central Book Agency, Kolkata. 2017, 1st Ed.
5. N. K. Vishnoi. *Advanced Practical Organic Chemistry.* Vikas Publishing House, New Delhi. 2009, 3rd Ed.

CH1 204: Physical Chemistry - I Laboratory (L-T-P-C: 0-0-4-2)

Program: B. Sc. Chemistry	**Semester:** II
Course code: CH1 204	**Course name:** Physical Chemistry - I Laboratory

Lecture (Hours)	Practical (Hours)	Credits	Total Hours	Evaluation Scheme			
				Component	Exam	Max. Marks	Passing %
--	4 per week	2	60	Practical	CCE, ESE	50	40

Course Objectives:

- Understand and investigate the physical properties of matter through experimental observation and measurement.
- Develop proficiency in classical techniques like viscometry, distillation, and conductivity measurements.
- Correlate experimental results with theoretical principles in states of matter and phase transitions.

Course Learning Outcomes: At the end of this course students will be able to
CLO1: Corelate the theory of Kinetic gas by doing some temperature-dependent experiments
CLO2: Understand the physical properties of different liquids
CLO3: Determine the Surface tension and viscosity of different analytical liquids

Sr. No.	Name of the Experiment	Hours
1	To demonstrate the Kinetic Theory of Gas at different temperatures. (https://sciencing.com/how-8211482-convert-atm-pressure-celsius.html)	**4**
2	To perform a comparative analysis of the physical properties of different liquids. (https://www.youtube.com/watch?v=jFWjjUKwCAk)	**8**
3	To determine the surface tension of a liquid using various analytical samples	**8**
4	To study the variation of surface tension of a detergent solution with concentration.	**8**
5	To estimate the viscosity coefficient of various analytical liquid samples by Ostwald's viscometry.	**8**
6	To determine the percent composition of a binary mixture by using surface tension	**8**
7	To separate two or more components by Paper Chromatography	**8**
8	To compare the conductivity of different electrolytes	**8**

CLO4: Comparison of the conductivity of different electrolytes

Syllabus

Reading References

1. B. D. Khosla; V. C. Garg; Adarsh Gulati. *Senior Practical Physical Chemistry.* R. Chand & Co., New Delhi. 2018, Revised Ed.
2. B. Viswanathan; P. S. Raghavan. *Practical Physical Chemistry.* Viva Books Private Limited, Navi Mumbai. 2017, 1st Ed.
3. K. Nad; B. Mahapatra; A. Ghoshal. *An Advanced Course in Practical Chemistry (Paperback).* New Central Book Agency Pvt. Ltd., Kolkata. 2022, 3rd Ed.
4. Viswanathan; P. S. Raghavan. *Practical Physical Chemistry.* Viva Books, New Delhi. 2012, Revised Ed.

CH1 205: Physics of Semiconductor Devices (L-T-P-C: 2-0-0-2)

Program: B. Sc. Chemistry	**Semester:** I
Course code: CH1 205	**Course name:** Physics of Semiconductor Devices

Lecture (Hours)	Practical (Hours)	Credits	Total Hours	Evaluation Scheme			
				Component	Exam	Max. Marks	Passing %
2 per week	--	2	30	Lecture	CCE, ESE	50	20

Course objectives: The students will learn

- The fundamentals of band theory which help them to understand the types of a solid material.
- The basics of different types of magnetic materials and magnetism related to them.
- The concept of superconductors and its use in real life applications.
- The basics of semiconductor and understand the different types of semiconducting materials along with the various types of application in semiconducting devices.

Course Learning Outcomes: At the end of this course students will be able to
CLO1: Remember the basic concept of band theories and the magnetic materials.
CLO2: Understand the basics of the semiconductors and its types.
CLO3: Classify the different materials in various categories according to their properties.
CLO4: Analyze the concepts of different types of semiconducting materials and able to demonstrate them.

Syllabus

Units	Content	Hours
Unit I: Band Theory of Solids	Free electron theory, Sommerfeld theory, Fermi Level and Fermi energy, Density of states, Energy band gap, concept of Effective mass and Metals, Insulators and Semiconductors, concept of susceptibility and permeability and relation between them. Magnetic materials, Types of magnetic material	**10**
Unit II: Superconductor and Superconductivity	Superconductor and Superconductivity, Properties of superconductors, Meissner's effect, Types of superconductors (Type I and Type II), London's Penetration depth, Applications of Superconductors, Thermodynamic and Optical Properties	**08**
Unit III: Semiconductor and Digital Electronics	Semiconductor and its properties, Direct and Indirect semiconductor, PN Junction diode, Forward Bias and Reverse Bias condition for PN junction and IV characteristics, charge carrier, carrier concentration, Brief introduction to Half wave rectifier, Full wave rectifier, efficiency, Filter circuits, Transistor and its type. LCR resonance circuit Boolean Algebra, De-Morgan's theorem, Logic Gates, Binary, Octal, Decimal and Hexadecimal number system and their mutual conversions, Illustrative examples.	**12**

Reading References:

1. R. K. Puri; V. K. Babbar. *Solid State Physics.* S. Chand & Co. Ltd., New Delhi. 2010, Revised Ed.
2. V. K. Mehta. *Principles of Electronics.* S. Chand & Co. Ltd., New Delhi. 2014, 7th Ed.
3. Arthur Beiser. *Concepts of Modern Physics.* Tata McGraw-Hill, New Delhi. 2002, 6th Ed.
4. R. K. Hair; S. L. Gupta. *Engineering Physics.* Dhanpat Rai Publications, New Delhi. 2012, Revised Ed.
5. Charles Kittel. *Introduction to Solid State Physics.* John Wiley & Sons, New York. 2018, 8th Ed.
6. S. M. Sze; Kwok K. Ng. *Physics of Semiconductor Devices.* Wiley, New York. 1996, 2nd Ed.
7. P. Bhattacharya. *Semiconductor Opto-Electronic Devices.* Prentice Hall, New Jersey. 1996, 2nd Ed.
8. M. K. Achuthan; K. N. Bhat. *Fundamentals of Semiconductor Devices.* McGraw Hill Education, New Delhi. 2007, 1st Ed.
9. J. Allison. *Electronic Engineering Materials and Devices.* McGraw Hill Education, New Delhi. 1990, Revised Ed.

CH1 206: Physics of Semiconductor Devices Laboratory (L-T-P-C: 0-0-4-2)

Program: B. Sc. Chemistry	**Semester:** II
Course code: CH1 206	**Course name:** Physics of Semiconductor Devices Laboratory

Lecture (Hours)	Practical (Hours)	Credits	Total Hours	Evaluation Scheme			
				Component	Exam	Max. Marks	Passing %
--	4 per week	2	60	Lab	CCE, ESE	50	20

Course objectives: The students will learn

- The fundamentals of various electronic devices such as diode, rectifier, etc. and their characteristics.
- The basics of different logic gates and understand their behaviour with truth tables so that they can use them in real life applications.
- The basics of semiconductor and understand the different types of semiconducting materials along with the various types of application in semiconducting devices.

Course Learning Outcomes: At the end of this course students will be able to
CLO1: Record different types of data for different instruments.
CLO2: Classify the devices according to their properties.
CLO3: Apply the theoretical knowledge of the course for the solving the given problem.
CLO4: Explain different characteristics of different electronic devices such as capacitor, diode, etc.
CLO5: Determine different parameters for various experiments.

Syllabus

Sr. No.	Name of the Experiment	Hours
1	To study and verify the PN junction Diode V-I characteristics in forward and reverse biasing.	**10**
2	To construct a half-wave rectifier circuit and analyze its output. To analyze the rectifier output using a capacitor in shunt as a filter.	**10**
3	To construct a full-wave bridge rectifier circuit and analyze its output. To analyze the rectifier output using a capacitor in shunt as a filter.	**10**
4	To study and verify the truth table of Logic gates.	**10**
5	To study the charging & discharging characteristics of a given capacitor.	**10**
6	To study and verify the Zener Diode V-I characteristics.	**10**

Reading references

1. Harnam Singh; P. S. Hemne. *B.Sc. Practical Physics.* S. Chand & Co., New Delhi. 2000.
2. C. L. Arora. *B.Sc. Practical Physics.* S. Chand & Co., New Delhi. 2010.
3. P. R. Sasi Kumar. *Practical Physics.* PHI Learning Pvt. Ltd., New Delhi. 2011.
4. Dinesh V. Kala. *Physics Practical Manual for UG & PG.* Dinesh Publications, New Delhi. 2020.
5. Amrita Vishwa Vidyapeetham. *Physics – Semiconductor Devices* [Online Resource]. Available at: https://www.amrita.edu/course/physics-semiconductor-devices

CH1 207: Chemistry of Materials (L-T-P-C: 2-0-0-2)

Program: B. Sc. Chemistry	**Semester:** II
Course code: CH1 207	**Course name:** Chemistry of Materials

Lecture (Hours)	Practical (Hours)	Credits	Total Hours	Evaluation Scheme			
				Component	Exam	Max. Marks	Passing %
4 per week	--	2	30	Lecture	CCE, ESE	50	20

Course objectives: The students will learn

- This course deals with understanding of chemistry of materials, especially solid-state materials, amorphous materials, crystalline materials, Polymeric materials, Dielectric materials and silicates.
- This course also covers the basics of nanomaterials.

Course Learning Outcomes: At the end of this course students will be able to
CLO1: Learn the basics of crystal lattice, structure of complex solid.
CLO2: Learn basics of porous materials and their types.
CLO3: Learn basics of polymeric materials, Dielectric materials, Silicates.
CLO4: Understand the fundamentals of Nanomaterial and their characterization techniques.

Syllabus

Unit	Content	Hours
Unit I: Inorganic Solids	**Solid State Materials:** Basic concept, Lattice energy, size effects, covalent character in ionic bonds, structures of complex solids, conductivity in ionic solids, and solids held together by different interactions. **Inorganic Solids:** Conventional heat and beat methods, Co-precipitation method, Sol-gel methods, Hydrothermal method, Ion-exchange and Intercalation methods. Inorganic solids of technological importance.	**10**
Unit II: Polymeric and Silicate Materials	**Polymeric Materials:** Different schemes of classification of polymers, polymer nomenclature, molecular forces, chemical bonding in polymers, and texture of polymers. Synthesis, characterization techniques, properties, and applications of any well-known polymer. Conducting polymers, porous polymers. **Silicates:** Glassy state and its properties, classification (silicate and nonsilicate glasses). Composition and properties of the following types of glasses: Soda lime glass, lead glass, armored glass, safety glass, borosilicate glass, fluorosilicate, colored glass, and photosensitive glass.	**10**
Unit III: Nanoporous materials	**Nanomaterials:** Basics of nanomaterial, Synthesis and Properties of nanomaterials, Role of size and shape, Characterization techniques and application of Nanomaterial. **Porous Materials:** Crystalline vs. amorphous solids, evolution and development of porous materials, the chemistry of microporous materials, mesoporous materials, macroporous materials, zeolite and zeolite-like materials.	**10**

Reading references Textbooks

1. Saylor Foundation. *General Chemistry: Principles, Patterns, and Applications.* Saylor.org, 2011.
2. A. R. West. *Solid State Chemistry and Its Applications.* Wiley, 2014, 2nd Ed.
3. J. F. Shackelford. *Introduction to Materials Science for Engineers.* Pearson Education, 2004, 6th Ed.
4. B. D. Cullity; S. R. Stock. *Elements of X-Ray Diffraction.* Pearson, 2001, 3rd Ed.
5. B. Averill; P. Eldredge. *Chemistry: Principles, Patterns, and Applications.* Pearson Education, 2007.

Reading References:

1. A. K. Cheetham; P. Day. *Solid State Chemistry: Techniques and Applications.* Oxford University Press, 1987.
2. P. A. Cox. *The Electronic Structure and Chemistry of Solids.* Oxford University Press, 1987.
3. K. J. Klabunde (Ed.). *Nanoscale Materials in Chemistry.* Wiley-Interscience, 2001.
4. N. N. Greenwood. *Ionic Crystal, Lattice Defect and Non-Stoichiometry.* Butterworths, 1968.
5. C. N. R. Rao; J. Gopalakrishnan. *New Directions in Solid State Chemistry.* Cambridge University Press, 1997, 2nd Ed.

Web reference:

https://ocw.mit.edu/courses/3-091sc-introduction-to-solid-state-chemistry-fall-2010/pages/syllabus/

CH1 208: Chemistry of Materials Laboratory (L-T-P-C: 0-0-4-2)

Program: B. Sc. Chemistry	**Semester:** II
Course code: CH1 208	**Course name:** Chemistry of Materials Laboratory

Lecture (Hours)	Practical (Hours)	Credits	Total Hours	Evaluation Scheme			
				Component	Exam	Max. Marks	Passing %
-	4 per week	2	30	Lecture	CCE, ESE	50	20

Course objectives: The students will learn

- This course deals with the practical knowledge of chemistry of materials, especially solid-state materials, amorphous materials, crystalline materials, Polymeric materials, Dielectric materials and silicates.
- This course mainly covers some material synthesis and characterization techniques along with some practical knowledge of nanomaterials.

Course Learning Outcomes: At the end of this course students will be able to
CLO1: Learn the basics of matter.
CLO2: Material synthesis techniques.
CLO3: Material characterization techniques.
CLO4: Analysis skill to correlate the synthesized material and their respective characterization data.

Syllabus

Sr. No.	Name of the Experiment	Hours
1	To analyze the crystal structure of a given sample	**5**
2	To identify and analyze the crystal imperfections in a given sample	**5**
3	To observe and analyze the thermosetting of plastic	**5**
4	To synthesize and characterize the nanoparticles by sol-gel method	**5**
5	To analyze the properties of various types of plastics	**5**
6	To prepare and characterize CNTs	**5**
7	To prepare and characterize metallic nanoparticles	**5**
8	To prepare porous materials	**5**

Reading References:

1. A. K. Cheetham and P. Day. *Solid State Chemistry: Techniques and Applications*. Oxford University Press, Oxford. 1987, 1st Ed.
2. P. A. Cox. *The Electronic Structure and Chemistry of Solids*. Oxford University Press, Oxford. 1987, 1st Ed.
3. K. J. Klabunde (Ed.). *Nanoscale Materials in Chemistry*. Wiley Interscience, New York. 2001, 1st Ed.
4. N. N. Greenwood. *Ionic Crystal, Lattice Defect and Non-Stoichiometry*. Butterworths, London. 1968, 1st Ed.
5. C. N. R. Rao and J. Gopalakrishnan. *New Directions in Solid State Chemistry*. Cambridge University Press, Cambridge. 1997, 2nd Ed.

CH1 209: Communication Skills-II (L-T-P-C: 2-0-0-2)

Program: B. Sc. Chemistry	**Semester:** II
Course code: CH1 209	**Course name:** Communication Skills-II

Lecture (Hours)	Practical (Hours)	Credits	Total Hours	Evaluation Scheme			
				Component	Exam	Max. Marks	Passing %
2 per week	--	2	30	Lecture	CCE, ESE	50	20

Course Objectives:

- Develop advanced oral communication and presentation skills through structured speaking activities and real-life simulations.
- Enhance understanding and application of advanced grammar and vocabulary for professional and academic communication.
- Apply reading strategies to comprehend technical and general texts, including case studies and media content.
- Strengthen formal writing skills by drafting reports, resumes, précis, advertisements and meeting documents.
- Demonstrate proper communication etiquette in telephonic, email and group discussion scenarios for workplace readiness.

Course Learning Outcomes: At the end of this course the students will be able to
CLO1: Apply basic and advanced grammar rules in speaking and writing.
CLO2: Communicate ideas clearly in group discussions, role plays and presentations.
CLO3: Use proper listening, telephone and email etiquette in real-life situations.
CLO4: Comprehend and analyze general and technical reading passages.
CLO5: Write reports, resumes, notices and minutes with correct format and structure.

Syllabus

Units	Content	Hours
Unit I: Advanced English Usage & Presentation Skills	**Communication Skills, Speaking & Grammar Communication & Speaking Skills** Oral Communication: 6 C's of Communication, conversation in pairs with the help of Cue-cards and effective presentation strategy, P's of presentation preparing outline of the presentation. Explaining their ideas and feelings in simple English. Situations will be drawn from their everyday experiences, group discussion dynamics, and brainstorming on current news affairs. Role plays based on formal and informal situations, Listening comprehension and summarization exercises, Telephone and email communication etiquette. **Advanced Grammar and Vocabulary** Voice –Active/Passive, Use of Adjective and Adverb, Difference between Simple, Compound and Complex sentences, confusables, affixes, idioms and one-word substitutes, Synonyms, antonyms, and vocabulary expansion tools	**15**

Unit II: Effective Reading & Writing Skills	**Reading Skills & Writing Skills** Reading comprehension of general passages, Reading Technical passages, Reading General passages, Reading cases/cases, and advertisements from newspapers/magazines. **Writing Skills** Defining report, the purpose of report writing & its significance, explaining various characteristics, types, and elements of report writing Discussing the difference between reference and bibliography, explaining the difference between Resume and Bio-data, preparing resume, explaining Précis writing and its significance and practice, Preparing Advertisement, Notice, agenda, and minutes of meeting writing	**15**

Reading References:

1. Dr. Sanjay Kumar and Dr. Pushp Lata. *Communication Skills: A Workbook*. Oxford University Press, New Delhi. 2018, 1st Ed.
2. Meenakshi Raman and Sangeeta Sharma. *Technical Communication: Principles and Practice*. Oxford University Press, New Delhi. 2015, 3rd Ed.
3. R. C. Sharma and Krishna Mohan. *Business Correspondence and Report Writing*. Tata McGraw-Hill, New Delhi. 2015, 8th Ed.
4. M. Ashraf Rizvi. *Effective Technical Communication*. SIA Publishers, Hyderabad. 2022, Latest Ed.

CH1 210: Techniques of Chemical Analysis (L-T-P-C: 2-0-0-2)

Program: B. Sc. Chemistry	**Semester:** II
Course code: CH1 210	**Course name:** Techniques of Chemical Analysis

Lecture (Hours)	Practical (Hours)	Credits	Total Hours	Evaluation Scheme			
				Component	Exam	Max. Marks	Passing %
2 per week	--	2	30	Lecture	CCE, ESE	50	40

Course Objective:

- Understanding of different chromatographic separation method, principles, and their advantages.
- To solve the Rf value of any unknown compound.
- Get idea about different concentration terms used for qualitative analysis with numerical.
- Develop the concept of conducting material and electrolysis.

Course Learning Outcomes: At the end of this course students will be able to
CLO1: Describe the principles of different chromatographic techniques.
CLO2: Calculate the Rf value for unknown compound
CLO3: Classify different concentration term, m and their correlation.
CLO4: Illustrate the concept of conductivity and electrolysis.

Syllabus

Units	Content	Hours
Unit I: Chromatographic separation	Principles of chromatographic separation, Rf factor, details study of paper and thin layer chromatography, different types of paper used in paper chromatography, normal and modified paper, advantages of paper chromatography, solvent system, eluents, chromatography as qualitative analysis, applications, importance of staining reagent (SR) in chromatography, types of SR and their application, consideration for selecting and using SR.	**15**
Unit II: Concentration of solution, Conductivity	Types of solutions: homogenous, heterogenous and other category with example, components of solution, concentration term: Mass percentage, Volume percentage, m/v percentage, Molarity (M), Molality, Normality (N), concept of Mole, mole fraction, ppm, relation of N and M, numerical, electrolysis and electrolytes, conductance in electrolytic solutions, metallic and ionic conductor, types of electrodes, mechanism of electrolysis, faraday's law, electrochemical equivalent weight, numerical.	**15**

Reading references:

1. Anna P. G. Nikalje. *A Handbook of Chromatography*. Scholar's Press Verlag Omniscriptam, Deutschland, Germany. ISBN: 978-3-330-65032-9.

CH1 211: Health and Nutrition (L-T-P-C: 2-0-0-2)

Program: B. Sc. Chemistry	**Semester:** II
Course code: CH1 211	**Course name:** Health and Nutrition

Lecture (Hours)	Practical (Hours)	Credits	Total Hours	Evaluation Scheme			
				Component	Exam	Max. Marks	Passing %
2 per week	--	2	30	Lecture	CCE, ESE	50	40

Course Objectives:

- To understand the nutritional aspects of food materials of human health.
- To differentiate different types of diseases caused by food infection and water contamination
- To study various control measures of water-borne disease.
- To analyze the role of food in disease progression.

Course Learning Outcome: At the end of the course, the student will be able to
CLO1: Understand the classification of various types of food items
CLO2: Explain the calorific value of food materials and balance diet
CLO3: Illustrate food and water-borne diseases
CLO4: Analyze impact of food and water on human health

Syllabus

Units	Content	Hours
Unit I: Food and Nutrition	**Food:** Basic concept of food, Types of plant and animal foods, Nutritional value. Balance diet, Calorific values of different food items, Cereals, Millets, Pulses, Fats & Oils, Fruits & vegetables, milk and milk products. **Nutrition:** Basics of nutrients, Macro and micro-nutrients, Essential nutrients, Food guide pyramid, Source and digestion of Carbohydrates, Proteins, Fats, Vitamins, and Minerals. Diseases related to food deficiency. Health and fitness.	**10**
Unit II: Food-borne Diseases	**Food Infections and Poisoning:** Types and control measures, Food poisoning of bacterial and Non-bacterial origin, Staphylococcus food poisoning, Botulism, Ergotism, Afflatoxicosis, Signs, symptoms, and safety measures, Probiotics-Nutritional and therapeutic aspects	**10**
Unit III: Waterborne Diseases	**Waterborne Infections:** Classification, Types and preventive measures, Amoebiasis, Cholera, *E. coli* infection, Dysentery, Typhoid fever, Hepatitis A, Poliomyelitis, Safety measures and primary treatment, Local water-borne diseases	**10**

Reading references:

1. B. Srilakshmi. *Food Science*. New Age International Pvt. Ltd., 2018, 7th Ed.
2. L. H. Meyer. *Food Chemistry*. CBS Publishers and Distributors, 2006, New Ed.
3. B. Poornima. *Fundamentals of Food Science, Technology and Processing and Preservation*. Centrum Press, 2012.

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