GURU NANAK COLLEGE (AUTONOMOUS)

(Affiliated to the University of Madras and Accredited at 'A++' Grade by NAAC)
Guru Nanak Salai, Velachery, Chennai – 600 042

SCHOOL OF SCIENCES
B.Sc., CHEMISTRY

(SEMESTER PATTERN WITH CHOICE BASED CREDIT SYSTEM)

Syllabus

(For the UG Batch of 2024-27 and thereafter)

LOCF - LEARNING OUTCOME BASED CURRICULUM FRAMEWORK

1. About the Programme - PREAMBLE

The purpose of under graduate education in Chemistry is to create highly skilled man power in specific areas, which leads to greater knowledge and creation of wealth of the nation. Chemistry is a fundamental science and has contributed immensely to the improvement of the life of people by providing many requirements and essentialities. The developments in chemistry during last few decades are phenomenal and it is also seen that more inclination is towards biological sciences. New branches of chemistry are emerging and gaining importance, such as bioorganic chemistry, bioinorganic chemistry, Nano chemistry, materials chemistry, computational chemistry, etc. Chemistry at industrial scale is also undergoing radical changes and is based on deep understanding the chemical phenomena. Inter disciplinary courses have also been included which will help the students to have wider knowledge of other disciplines. To equip the students to face the challenges of life, new skill courses have been introduced. Green chemistry has emerged as a new approach to the practice of Chemistry. Chemical industry is now under pressure from both the Government and the Society to develop ecofriendly processes and products which will reduce waste and prevent toxic substances from entering the environment. Efforts are taken to minimize polluting the environment and at the same time not compromising with the gain of knowledge which will enable the students to accept any challenge in chemistry and to move towards research.

2. Vision

To enhance the quality of education beyond the text book / syllabi based – exam oriented system to research and analytical based learning, to encourage the learners of exceptional quality to take up research and motivate them to contribute to the needs of the society and to encourage the faculty to constantly involve themselves in research in addition to the regular work, which would enable them to develop research oriented learning skills.

3. Mission

- To inculcate the scientific methodology of learning chemistry by focusing more on practical.
- To enhance the creativity in learning chemistry among the learners using visual aids.

- ❖ To circulate the scientific methodology of learning among the learners.
- ❖ To facilitate the learning of chemistry in a systematic manner that would enrich the creativity among the learners.
- ❖ To produce quality graduates and post graduates to excel in the field of education / research / industry.
- ❖ To produce and to modernize the infra-structure to impart and understand the importance of practical skill accuracy and data interpretation.
- ❖ To encourage the learners to participate in the teaching – learning process to enhance their analytical and problem solving skill and to develop leadership qualities.
- ❖ To motivate the students by conducting seminars/workshops with the inputs of eminent scientists, distinguished alumni and industrialist.
- ❖ Visit to Industries and scientific center to have exposure on sophisticated instruments and recent developments in chemistry.

4. Program Educational Outcomes (PEOs)

PEO 1: Values of Life, Ethics & Social Concern

The graduates exhibit truth, loyalty, and love as integral moral principles, thereby contributing to a society characterized by enhanced well-being and fundamental goodness in behavior.

PEO 2: Employability & Entrepreneurship

The graduates apply analytical, logical, and critical problem-solving skills in professional contexts, elevating employability and cultivating entrepreneurial capabilities through upskilling.

PEO 3: Regional/National/Global Relevance & Competency

The graduates foster advanced analytical skills and a heightened appreciation for current Regional/National/Global perspectives, enabling informed and sustainable decision-making in a dynamic environment.

PEO 4: Skill Enhancement, Self-Directed & Lifelong Learning

The graduates independently engage in skill-based learning, utilizing infrastructure and opportunities for continuous upskilling, enabling self-evaluation and lifelong excellence attainment.

PEO 5: Research Skills & Innovation

The graduates proficiently apply scientific reasoning, fostering creativity, strategic thinking, and

effective problem-solving skills. They demonstrate a core competency in generating innovative ideas for advancements and inventions.

5. Program Outcomes (POs)

After completion of the programme, the student will be able to

PO 1 : Instill scientific and analytical reasoning to empower students towards critical thinking thereby enriching inter/multi-disciplinary knowledge.

PO 2 : Encourage self-regulated learning leading to problem-solving skills and adaptability.

PO 3 : Incorporate experiential learning opportunities and engage in tangible situations to develop essential life skills.

PO 4 : Enhance application skills by interconnecting academia and professional realm to achieve employability.

PO 5 : Foster research abilities to address everyday challenges, make impactful contributions, and participate in shaping a better future for the society.

6. Program Specific Outcomes (PSOs)

The students at the time of graduation will be able to

PSO 1: Understand the basic principles of organic, inorganic, physical, analytical and industrial chemistry and its application.

PSO 2: Gain and understand the knowledge of Chemistry through - theory via conducting the experiments, practical via theory.

PSO 3: Establish their skill in planning and conducting chemistry experiments, enabling them to handle classes at the secondary level.

PSO 4: Follow the good and safe laboratory practice, including maintenance of laboratory record, log book, identify the hazardous chemicals and its safety handling.

PSO 5: Develop a creative scientific presentation to the society, based on the need and communicate effectively the scientific ideas and their impact on socio-economic issues.

7. PEO – PO mapping

	PEO 1	PEO 2	PEO 3	PEO 4	PEO 5
PO 1	3	3	3	3	3
PO 2	3	3	2	3	3
PO 3	3	3	3	3	2
PO 4	3	3	2	3	3
PO 5	3	3	3	3	3

8. PO – PSO mapping

	PO 1	PO2	PO3	PO4	PO5
PSO 1	3	3	3	3	2
PSO 2	3	3	2	3	3
PSO 3	3	2	2	3	3
PSO 4	2	3	3	3	3
PSO 5	3	3	3	3	3

9. Choice Based Credit System (CBCS)

The College follows the CBCS with Grades under the Semester pattern. Each course is provided with a credit point based on the quantum of subject matter, complexity of the content and the hours of teaching allotted. This is done after a thorough analysis of the content of each subject paper by the members of the Board of Studies and with the approval of the Academic Council. Students are also offered a variety of Job oriented Elective, Multidisciplinary skill-based courses as part of the curriculum. Students can earn extra credits by opting for Massive Open Online Courses (MOOCs) and Certificate Courses.

The evaluation method under CBCS involves a more acceptable grading system that reflects the personality of the student. This is represented as Cumulative Grade Point Average (CGPA) and Grade Point Average (GPA) which are indicators of the Academic Performance of the student. It provides students with a scope for horizontal mobility and empowers them with the flexibility of learning at their convenience.

Eligibility for Admission

Candidates admitted to the first year of the UG programme should have passed the higher Secondary Examinations (Academic or Vocational Stream) conducted by the Government of Tamil Nadu or an examination accepted as equivalent thereof by the Syndicate of the University of Madras. Students applying for the PG programme should have taken the UG degree in the relevant subject from a recognized university as per the norms of the University of Madras.

Duration of the Course

The UG programme is of three years duration with six semesters and the PG programme is of two years duration with four semesters. The period from June to November is termed as the odd semester and the period from December to April is referred to as the even semester. Each semester must compulsorily have 90 working days before the students appear for the final End Semester Exam.

Course of Study

The main course of study for the Bachelor's Degree shall consist of the following:

FOUNDATION COURSES

PART - I: Tamil/ Hindi /Sanskrit/French

PART - II: English

CORE COURSES

PART - III: Consisting of (a) Main subject (b) Allied Subjects (c) Elective subjects related to the main subject of study and project work.

PART – IV: Those who have not studied Tamil up to XII standard and have taken a non- Tamil language under Part – I, shall opt for Basic Tamil in the first two semesters.

Those who have studied Tamil up to XII standard, and taken a non -Tamil language under Part – I, shall opt for Advanced Tamil in the first two semesters.

Others, who do not come under either of the clauses mentioned above, can choose a Non-Major Elective (NME) in the first two semesters.

Soft Skills (I, II, III & IV Semesters)

Self-Study (Compulsory) Course (III Semester)

Environmental Studies (IV Semester)

Value Education (V Semester)

Summer Internship (After IV Semester)

PART - V: Compulsory Extension Services

A Student shall be awarded one credit for compulsory extension service. A student must enroll in NSS / NCC /Sports & Games/ Citizen Consumer Club / Enviro Club or any other service organization in the College and should put in compulsory minimum attendance of 40 hours, which shall be duly certified by the Principal of the College. If a student lacks 40 hours compulsory minimum attendance in the extension services in any Semester, s/he shall have to compensate the same, during the subsequent Semesters.

COURSE STRUCTURE

The UG programme consists of 15-19 Core courses with 3-4 credits for each paper, 3 Elective courses and 4 Allied courses with 4-5 credits for each paper in addition to 4 Soft Skill courses with two credits each. Internship as a compulsory component carries 2 credits.

Internship training is a compulsory component for all the UG & PG programmes.

10.Consolidated Credit Structure

Component	**No. of Papers**	**Credits**
Language	4	12
English	4	12
Core (Including Practical)	16	60
Allied (Including Practical)	5	20
Elective	6	21
Soft Skills	4	8
Internship	1	2
Mini Project	1	2
Environmental Studies	1	2
Value Education	1	2
Extension Activity	-	1
Total		**142**

11. Credit Distribution for Each Semester

Semester I Course Component		Subject	Hours/Week	Credit	Marks		Total
					Internal	External	
Part I	Language	Language–I	6	3	50	50	100
Part II	English	English–I	4	3	50	50	100
Part III	Core-I (Theory)	Basic Chemistry – I	5	4	50	50	100
	Core-II (Practical)	Volumetric Analysis and Inorganic Preparations	3	*	50	50	100
	Allied-I	Mathematics – I	8	5	50	50	100
Part IV	Non-Major Elective-I	Basic Tamil-I /Advanced Tamil-I/ Elective Paper offered by the respective programme**	2	2	50	50	100
	Soft Skills-I	Communication Skill and Personality Development Skills	2	2	50	50	100
	Total		**30**	**19**			

Semester II Course Component		Subject	Horus/Week	Credit	Marks		Total
					Internal	External	
Part I	Language	Language–II	6	3	50	50	100
Part II	English	English– II	4	3	50	50	100
Part III	Core- III (Theory)	Basic Chemistry - II	5	4	50	50	100
	Core -II (Practical)	Volumetric Analysis and Inorganic Preparation	3	3	50	50	100
	Allied-II	Mathematics – II	8	5	50	50	100
Part IV	Non Major Elective-II	Basic Tamil-II/ Advanced Tamil-II/ Elective Paper offered by the respective programme**	2	2	50	50	100
	Soft Skills-II	Interview Skills and Resume Writing	2	2	50	50	100
	Total		**30**	**22**			

Semester III Course Component		Subject	Hours/Week	Credit	Marks		Total
					Internal	External	
Part I	Language	Language–III	6	3	50	50	100
Part II	English	English–III	4	3	50	50	100
Part III	Core-IV (Theory)	Organo-oxygen compounds	5	4	50	50	100
	Core -V (Practical)	Inorganic Qualitative Analysis	3	*	50	50	100
	Core Paper#	Mini Project#	2	2	50	50	100
	Allied-III	Physics – I	5	3	50	50	100
	Allied Practical	Allied Physics Practical	3	*	50	50	100
Part IV	Soft Skills-III	Digital Proficiency and Multimedia Skills	2	2	50	50	100
	Self-Study (Compulsory Course) Can choose any one	Indian Heritage and Knowledge System/ Contemporary World and Sustainable Development	-	2	50	50	100
	Total		**30**	**19**			

Semester IV Course Component		Subject	Hours/Week	Credit	Marks		Total
					Internal	External	
Part I	Language	Language–IV	6	3	50	50	100
Part II	English	English–IV	4	3	50	50	100
Part III	Core-VI (Theory)	Chemistry of s and p Block Elements	5	4	50	50	100
	Core -V (Practical)	Inorganic Qualitative Analysis	3	3	50	50	100
	Allied-IV	Physics – II	5	3	50	50	100
	Allied Practical	Allied Physics Practical	3	4	50	50	100
Part IV	Soft Skills-IV	Foundations of Quantitative Aptitude	2	2	50	50	100
	EVS	Environmental Studies	2	2	50	50	100
	Total		**30**	**24**			

Semester V Course Component		Subject	Hours/Week	Credit	Marks		Total
					Internal	External	
Part III	Core-VII (Theory)	Organo Nitrogen Compounds and Natural Products	4	4	50	50	100
	Core- VIII (Theory)	Chemical Kinetics and Electrochemistry	4	4	50	50	100
	Core-IX (Theory)	Special topics in Chemistry	4	4	50	50	100
	Core-X (Theory)	Analytical Chemistry - I	4	4	50	50	100
	Core –XI (Practical)	Gravimetric Analysis	3	*	50	50	100
	Core -XII (Practical)	Analysis and Preparation of Organic Compounds	2	*	50	50	100
	Core -XIII (Practical)	Physical Chemistry Practical	3	*	50	50	100
	Elective – I##	IDE## – Chemistry in Everyday life / Essentials of Chemistry	5	5	50	50	100
Part IV	Value Education	Value Education	1	2	50	50	100
	Internship###	Internship###	-	2	-	-	-
	Total		**30**	**25**			

Semester VI Course Component		Subject	Hours/Week	Credit	Marks		Total
					Internal	External	
Part III	Core Theory – XIV	Thermodynamics and Solutions	4	4	50	50	100
	Core Theory – XV	Chemistry of d and f block elements and Coordination chemistry	4	4	50	50	100
	Core Theory – XVI	Analytical Chemistry - II	4	4	50	50	100
	Elective – II	***	5	5	50	50	100
	Elective - III	***	5	5	50	50	100
	Core -XI (Practical)	Gravimetric Analysis	3	4	50	50	100
	Core –XII (Practical)	Analysis and preparations of Organic Compounds	2	3			
	Core -XIII (Practical)	Physical Chemistry Practical	3	3	50	50	100
Part V	Extension Activity	Participation in NSS/NCC/ Enviro Club, etc.	-	1	-	-	-
	Total		**30**	**33**			
Grand Total				**142**			

* The practical examinations will be conducted at the end of even semester.

** The students must choose one NME course in Semester – I and one NME course in Semester – II offered by other departments.

NME Courses offered by department of chemistry to other departments:

1. Dairy Chemistry
2. Food Chemistry
3. Forensic Chemistry
4. Role of Chemistry in Daily Life

*** The students must choose **two elective** courses in Semester - VI from the list of offered electives.

List of Elective Courses:

1. Nanochemistry and Nanotechnology
2. Industrial Chemistry
3. Pharmaceutical Chemistry
4. Applied Electrochemistry
5. Polymer Chemistry

The students must do a mini project (Group project) during third semester and report to be submitted.

The students must choose Inter Disciplinary Elective (IDE) offered by other departments in Semester V.

IDE courses offered by department of chemistry to other departments:

1. Chemistry in Everyday Life
2. Essentials of Chemistry.

The students must undergo summer internship for **21 days** after the fourth semester and the report to be submitted.

EXAMINATION

Continuous Internal Assessment (CIA) will be for 50 percent and

End Semester Examination (ESE) will be for 50 percent.

CONTINUOUS INTERNAL ASSESSMENT (CIA)

Every semester will have a mid-semester examination which will be conducted on completion of 45 working days in each semester. A Model exam for three hours duration will be conducted on completion of 80 working days in each semester. For the courses coming under Part IV, ESE will be conducted in MCQ pattern. Internship credits will be given in semester V after verification of documents by the respective Heads.

The schedule for these tests is as follows:

CIA	Schedule	Syllabus Coverage
Mid Semester Examination	After **45** working days of the Semester	60%
Model Examination	After **80** working days of the Semester	95%

The class activity relates to a programme of accepted innovative techniques such as Seminar, Quiz, Portfolio creation, PowerPoint presentation, Objective tests, Role play, Group discussion, Case Study etc. The mode of evaluation of the class activity will be fixed before the commencement of the semester and an approval will be obtained from the Head of the programme/wing. The students will be informed of the various methods of evaluation once the semester begins.

A record of all such assessment procedures will be maintained by the department and is open for clarification. Students will have the right to appeal to the Principal in case of glaring disparities in marking. CIA marks for practical subjects will be awarded by the respective faculty based on the performance of the student in the model practical examination, observation notebook, submission of record books, regularity and attendance for the practical classes. The attendance particulars for practical classes will be maintained by the concerned faculty. The marks for attendance will be awarded as per the following:

% of General Attendance	Marks Awarded
90-100	5
75-89	4
60-74	3
<60	0

END SEMESTER EXAMINATIONS (ESE)

After the completion of a minimum of 90 working days each semester, the End Semester Examinations will be conducted. Examinations for all UG and PG programmes will be held for all courses in November/December and April/May. Practical examinations will be conducted only during the end of the odd / even semester before, during or after the commencement of the theory exam. The

schedule for ESE Practicals will be notified by the Controller of Examinations in consultation with the Dean (Academics).

12. Mode of Evaluation

METHODS OF EVALUATION		
Internal Evaluation	Mid Sem Exam (10)	50 Marks
	Model Exam (10)	
	Assignment (10)	
	Class activity (15)	
	Attendance (5)	
External Evaluation	End Semester Examination	50 Marks
Total		100 Marks

13. Method of assessment

Remembering (K1)	• The lowest level of questions requires students to recall information from the course content • Knowledge questions usually require students to identify information in the textbook. • Suggested Keywords: **Choose, Define, Find, How, Label, List, Match, Name, Omit, Recall, Relate, Select, Show, Spell, Tell, What, When, Where, Which, Who, Why**
Understanding (K2)	• Understanding off acts and ideas by comprehending organizing, comparing, translating, interpolating and interpreting in their own words. • The questions go beyond simple recall and require students to combined at altogether • Suggested Keywords: **Classify, Compare, Contrast, Demonstrate, Explain, Extend, Illustrate, Infer, Interpret, Outline, Relate, Rephrase, Show, Summarize, Translate**
Application (K3)	• Students have to solve problems by using / applying a concept learned in the classroom. • Students must use their knowledge to determine a exact response. • Suggested Keywords: **Apply, Build, Choose, Construct, Develop, Experiment with, Identify, Interview, Make use of, Model, Organize, Plan, Select, Solve, Utilize**
Analyze (K4)	• Analyzing the question is one that asks the students to breakdown something into its component parts. • Analyzing requires students to identify reasons causes or motives and reach conclusions or generalizations. • Suggested Keywords:

	Analyze, Assume, Categorize, Classify, Compare, Conclusion, Contrast, Discover, Dissect, Distinguish, Divide, Examine, Function, Inference, Inspect, List, Motive, Relationships, Simplify, Survey, Take part in, Test for, Theme
Evaluate (K5)	• Evaluation requires an individual to make judgment on something. • Questions to be asked to judge the value of an idea, a character, a work of art, or a solution to a problem. • Students are engaged in decision-making and problem–solving. • Evaluation questions do not have single right answers. • Suggested Keywords: **Agree, Appraise, Assess, Award, Choose, compare, Conclude, Criteria, Criticize, Decide, Deduct, Defend, Determine, Disprove, Estimate, Evaluate, Explain, Importance, Influence, Interpret, Judge, Justify, Mark, Measure, Opinion, Perceive, Prioritize, Prove, Rate, Recommend, Rule on, Select, Support, Value**
Create (K6)	• The questions of this category challenge students to get engaged in creative and original thinking. • Developing original ideas and problem solving skills • Suggested Keywords: **Adapt, Build, Change, Choose, Combine, Compile, Compose, Construct, Create, Delete, Design, Develop, Discuss, Elaborate, Estimate, Formulate, Happen, Imagine, Improve, Invent, Make up, Maximize, Minimize, Modify, Original, Originate, Plan, Predict, Propose, Solution, Solve, Suppose, Test, Theory**

SEMESTER - I

PROGRAMME: B. Sc. CHEMISTRY	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** CORE-I
COURSE NAME: BASIC CHEMISTRY – I	**COURSE CODE:**
SEMESTER: I	**MARKS:**100
CREDITS: 4	**TOTAL HOURS:** 75
THEORY	

COURSE OBJECTIVE:

To introduce fundamental concepts of Physical, Organic and Inorganic Chemistry.

COURSE OUTCOMES:

1. Acquire basic knowledge on atomic structure, quantum mechanical postulates, quantum number and shape of orbitals.
2. Understand the periodic classification of elements and their properties.
3. Acquire knowledge about hybridisation, chemical bonding and predict the geometry of molecules based on VSEPR theory.
4. Name the organic compounds of various functional groups using IUPAC nomenclature and to predict the isomerism related to the compounds.
5. Classify the reaction as substitution, elimination, addition and rearrangements and to understand polar effects, reaction intermediates and their applications in organic chemistry.

UNIT I: Atomic Structure (15 HOURS)

Rutherford's atomic model. Bohr's theory of Hydrogen atom - Postulates, Bohr's radius, energy of hydrogen like species - Planck's quantum theory - Photoelectric effect - Compton effect- Hydrogen atomic spectrum - Particle and wave nature of electron - deBroglie equation - Heisenberg's uncertainty principle.

Quantum mechanical postulates, Operators - addition, subtraction, multiplication, linear, Hermitian, Commutator, Vector, Laplacian and Hamiltonian. Schrodinger's wave equation (Derivation not required). Significance of Ψ and Ψ^2. Wave mechanical concept of atomic orbitals - Shapes of orbitals - Quantum Number. Zeeman effect.

Pauli's exclusion principle, Hund's rule - its basis and applications.

UNIT II: Periodic Classification and Periodicity in Properties (15 HOURS)

Aufbau principle, effective nuclear charge, screening effect, Slater's rule- applications and limitations. Electronic configuration of elements- extra stability of half - filled and completely filled atomic orbitals.

Classification of elements - s, p, d and f block elements. Modern periodic table - position of hydrogen in the periodic table. Periodicity of the following properties – atomic size, ionization

potential, electron affinity and electro negativity, horizontal, vertical and diagonal relationships in the periodic table.

Scales of electronegativity - Pauling, Mulliken and Allred - Rochow.

UNIT III: Chemical Bonding (15 HOURS)

Types of bond - ionic bond - factors influencing the formation of ion in compounds- iionisation energy, electron affinity and lattice energy. Determination of lattice energy – Born Haber cycle, Inert pair effect, Fajan's rule. Covalent bond – polarity of covalent bond, percentage ionic character of covalent bond, dipole moment- Molecular structures of CO_2, H_2O, NH_3 and CH_4 - Bond characteristics - bond length, bond strength, bond angle and bond energy.

Valence Bond theory – sigma (σ) and pi (π) bonds- Hybridisation, Valence shell electron pair repulsion theory (VSEPR) and geometries of molecules – $BeCl_2$, H_2O, BF_3, NH_3, XeF_4, BrF_3, PCl_5, SF_6 and IF_7. Molecular Orbital Theory - Bonding and antibonding orbitals, bond order, applications of MO theory to H_2, He_2, N_2, O_2, O_2^+, O_2^-, HF and CO. Comparison between VBT and MO theory - Hydrogen bonding – types and consequences.

UNIT IV: Nomenclature of Organic Compounds and Isomerism (15 HOURS)

Nomenclature of organic compounds: IUPAC system of nomenclature of organic compounds – mono and bifunctional compounds. Hybridisation and shapes of molecules - methane, ethane, ethylene, acetylene and benzene. Structural isomerism: chain isomerism, position isomerism, functional isomerism, metamerism and tautomerism.

UNIT V: Electronic Effects, Types of Reactions, Types of Intermediates (15 HOURS)

Organic reactions – types (Substitution, Elimination, Addition, Rearrangement) with examples. Electron displacement effects - inductive, electromeric, mesomeric, resonance,hyper conjugation, steric effect and their applications (acid, base strength and dipole moment) Cleavage of bonds – homolytic and heterolytic fissions. Reactive intermediates - carbocations, carbanions, free radicals, carbenes, nitrenes and benzynes - their formation and stability.

PRESCRIBED BOOKS:

1. Arun Bahl and B. S. Bahl, Advanced Organic Chemistry, S. Chand & Company Pvt.Ltd, Second Edition, 2012.
2. M. K. Jain and S. C. Sharma, Modern Organic Chemistry, Vishal Publishing Co., Fourth Edition, 2009.

3. P.S. Kalsi, Organic reactions and their Mechanism, New Academic Sciences, Fifth Edition, 2021.
4. B. R. Puri, L. R. Sharma and K. C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers and Distributors, New Delhi, 33rd Edition, 2019.
5 . P. L. Soni and Mohan Katyal, Textbook of Inorganic Chemistry, Sultan Chand & Sons, Twentieth Edition, 2017.

REFERENCE BOOKS:

1. J.E.Huheey, E.A. Kieter and R.L. Keiter, Inorganic Chemistry, Harper Collins, NewYork, Fourth edition,2013.
2. D.F. Shriver and P. W. Atkins, Inorganic Chemistry, W. H. Freeman and Co, London,Fifth Edition, 2010.
3. R. T. Morrison, R. N. Boyd, and S. N. Bhattacharjee, Organic Chemistry, Pearson Education, Asia, Seventh Edition, 2012.

E-LEARNING RESOURCES:

1. www.epgpathshala.nic.in
2. www.nptel.ac.in
3. http:/swayam.gov.in
4. Virtual Textbook of Organic Chemistry

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions(each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions(each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions(each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS FOR THEORY

UNIT	SECTION A	SECTION B		SECTION C
		Theory	Problem	
I	3	1	1	2
II	3	1		1
III	2	1		1
IV	2	2		1
V	2	1		1
TOTAL	**12**	**7**		**6**

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
Ave.	3	3	3	3	3

PSO-CO-question paper mapping

CO No.	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	To acquire basic knowledge on atomic structure, quantum mechanical postulates, quantum number, shape of orbitals.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO2	To understand the periodic classification of elements and their properties.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO3	To acquire knowledge about hybridisation, chemical bonding and predict the geometry of molecules based on VSEPR theory.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO4	To name the organic compounds of various functional groups using IUPAC nomenclature and to predict the isomerism related to the compounds.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO5	To classify the reaction as substitution, elimination, addition and rearrangements and to understand polar effects, reaction intermediates and their applications in organic chemistry.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

PROGRAMME: B. Sc. CHEMISTRY	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** CORE -II
COURSE NAME: VOLUMETRIC ANALYSIS AND INORGANIC PREPARATION	**COURSE CODE:**
SEMESTER: I/II	**MARKS:**100
CREDITS: 3	**TOTAL HOURS:** 45
PRACTICAL	

COURSE OBJECTIVE:

To expertise the practical skill in the quantitative chemical analysis and chemical preparations.

COURSE OUTCOMES:

1 Handle the analytical balance, standard flask, volumetric pipettes, burette and chemicals safely.

2 Prepare solutions of various molar and normal concentrations.

3 Understand the types of error in the experiments, calibration of instruments, QC labs in industries.

4 Design, carry out, record and interpret the results of volumetric titration.

5 Get an idea about preparation of inorganic compounds and complex.

(A) Volumetric Analysis

1. Estimation of HCl using standard oxalic acid solution.
2. Estimation of Na_2CO_3 using standard Na_2CO_3 solution.
3. Estimation of oxalic acid using standard oxalic acid solutions.
4. Estimation of Fe (II) sulphate using standard Mohr's salt solution.
5. Estimation of $KMnO_4$ using standard $K_2Cr_2O_7$ solution.
6. Estimation of Fe (II) using standard Fe(II) solution.
7. Estimation of Cu(II) sulphate using standard $K_2Cr_2O_7$ solution.
8. Estimation of Mg(II) by EDTA.
9. Estimation of total hardness of water.
10. Analysis of mixture of carbonate and bicarbonate.
11. Estimation of Vitamin C in fruit juices.

(B) Preparation of Inorganic Complexes

1. Ferrous ammonium sulphate
2. Tetraamminecopper(II) sulphate
3. Microcosmic salt
4. Prussian Blue
5. Hexaamminenickel(II) chloride

REFERENCES:

1. A.L. Vogel, Text book of Inorganic Quantitative Analysis, ELBS, third edition, 1976.
2. G.S.Vehla, Vogel's Textbook of Macro and Semimicro Qualitative InorganicAnalysis, fifth edition, Revised, 1979.

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
Ave.	3	3	3	3	3

PROGRAMME: B. Sc. CHEMISTRY	**BATCH:** 2024-27
PART: IV	**COURSE COMPONENT:** SOFT SKILL -1
COURSE NAME: COMMUNICATION AND PRESENTATION SKILLS	**COURSE CODE:**
SEMESTER: I	**MARKS:** 100
CREDITS: 2	**TOTAL HOURS:** 30
THEORY	

COURSE OBJECTIVE:

To build communication skills for personal and professional development.

COURSE OUTCOMES:

1. Demonstrate the ability to listen to others actively, understand diverse perspectives, and paraphrase key points accurately, enhancing their comprehension skills in various personal and professional contexts.
2. Articulate thoughts, ideas, and information clearly and concisely, using appropriate language and structure to convey messages effectively in both written and verbal communication.
3. Develop confidence in expressing opinions, asserting boundaries, and advocating for themselves and others, enhancing self-assurance and effectiveness in interpersonal and group communication.
4. Adapt their communication style and approach based on the audience, context, and purpose of communication, fostering flexibility and versatility in interacting with diverse individuals and groups.
5. Acquire techniques for resolving conflicts, managing disagreements, and negotiating mutually beneficial outcomes through effective communication strategies, promoting constructive problem-solving and collaboration in personal and professional settings.

UNIT I: Essentials of Effective Communication (6 Hours)

Communication Skills-LSRW- Characteristic features of LSRW-Consequences of Ineffective Communication-Impact of technology on Communication.

UNIT II: Types of Communication (6 Hours)

Verbal Communication – Non-verbal Communication- Visual Communication - Written Communication-Group Communication-Digital Communication-Formal and Informal Communication-Vertical-Horizontal-Diagonal Grapevine

UNIT III: Barriers in Communication (6 Hours)

Physical Barriers - Language Barriers - Social and Cultural Barriers - Psychological Barriers - Semantic Barriers - Interpersonal Barriers - Technological Barriers- Means to overcome the various barriers to Communication

UNIT IV: Etiquettes and Ethical Practices in Communication (6 Hours)

Active Listening - Clarity and Conciseness - Professional Tone - Timeliness - Constructive Feedback-Transparency-Professionalism-Accountability-Confidentiality-Cultural Sensitivity- Emotional Intelligence-Empathy-Social Intelligence-Social Etiquettes- Appreciation and Gratitude.

UNIT V: Presentation Skills (6 Hours)

Types of Presentation- Preparing a presentation -Do's and Don'ts while giving a presentation-Managing tools for Presentation-Using Prompts-Making effective uses of Audio/Visual aids during presentation-Dealing with Questions, Interruptions and Pauses- Practical: Participating in Mock presentations.

PRESCRIBED BOOKS:

1. Monippally, Matthukutty, M. Business Communication Strategies. New Delhi: Tata McGraw- Hill Publishing Company Ltd., 2001.
2. Peter, Francis. (2012) Soft Skills and Professional Communication. New Delhi: Tata McGraw Hill.
3. Raman, Meenakshi & Prakash Singh (2012) Business Communication Oxford University Press

REFERENCE BOOKS:

1. Gallo, Maria. D (2018) Stop Lecturing Start Communicating: The Public Speaking Survival Guide for Business Kindle Edition
2. Hasson, Gill. (2012)Brilliant Communication Skills. Great Britain: Pearson Education.
3. Patil, Shailesh (2020) Handbook on Public Speaking, Presentation & Communication Skills: Principles & Practices to create high impact presentations & meaningful conversations, Chennai, Notion Press Media Pvt. Ltd.

E-LEARNING RESOURCES:

1. https://uwaterloo.ca/centre-for-teaching-excellence/catalogs/tip-sheets/effective-communication- barriers-and-strategies
2. https://www.coursera.org/articles/presentation-skills
3. https://positivepsychology.com/how-to-improve-communication-skills/

SEMESTER - II

PROGRAMME: B. Sc. CHEMISTRY	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** CORE-III
COURSE NAME: BASIC CHEMISTRY – II	**COURSE CODE:**
SEMESTER: II	**MARKS:**100
CREDITS: 4	**TOTAL HOURS:** 75
THEORY	

COURSE OBJECTIVE:

To provide knowledge on fundamentals of chemistry.

COURSE OUTCOMES:

1. Demonstrate the concepts related to nuclear structure, stability of the nuclei, nuclear isomers, nuclear reaction, different modes of radioactive decay and nuclear reactor.
2. Predict the elements of symmetry and to explain the type of defects in crystals
3. Acquire knowledge about preparation, important chemical properties and uses of hydrocarbons and poly nuclear hydrocarbons.
4. Gain an understanding of principles of quantitative, qualitative analysis and to conduct the experiments.
5. Understand the reaction mechanism in aromatic and aliphatic compounds, types of reaction, to understand the orientation and reactivity in substituted benzene.

UNIT I: Nuclear chemistry (15 HOURS)

Fundamental particles of the nucleus - nucleon - terminology, nucleides, isotopes, isobars, isotones, mirror nuclei, nuclear radius, nuclear mass and nuclear forces operating between the nucleons. n/p ratio, curves, stability belts. Nuclear binding energy, Mass defect, simple calculations involving mass defect and bond energy per nucleon. Shell model - Magic numbers - liquid drop model.

Radioactivity - group displacement law, natural radioactivity – radioactive series including neptunium series. Artificial radioactivity – induced radioactivity – uses of radio isotopes. Nuclear fission – Nuclear energy - Nuclear reactors – Breeder reactor – Nuclear fusion.

UNIT II: Solid State (15 HOURS)

Classification of solids, isotropic and anisotropic crystals, elements of symmetry, crystal systems, space lattices - Bravais lattice, designation of planes-Miller indices, unit cell. Packing of ions in crystals (CCP, BCC and HCP).

X - ray diffraction – derivation of Bragg's equation, Discussion of structures of NaCl, CsCl and ZnS. Determination of Avogadro's number, Problems related to solid state chemistry (density, interplanar distance, theta (Θ) and wavelength, etc.). Defects in crystals – Stoichiometric and non-stoichiometric defects; Frenkel, Schotky defects, metal excess and metal deficiency defects, colour centers.

UNIT III: Hydrocarbons (15 HOURS)

Alkanes – mechanism of free radical substitution in alkanes. Cycloalkanes - general methods of preparation (Wurtz's reaction, Dieckmann's reaction) – Bayer's strain theory and theory of strainless rings. Alkenes - preparation and properties – Electrophilic and free radical addition - Orientation of addition reaction (Markovnikov's rule and peroxide effect) – addition reaction, oxidation, ozonolysis and hydroboration. Hydroxylation with $KMnO_4$,OsO_4, allylic substitution by NBS. Diene – Classification – stability and reactivity of1, 2 and 1, 4 - addition. Synthesis of diene - 1, 3 - butadiene, isoprene and chloroprene. Alkynes – preparation and properties – acidity of alkynes, formation ofacetylides, addition reaction, oxidation, ozonolysis and hydroboration.

UNIT IV: Principles of Quantitative and Qualitative Analysis (15 HOURS)

Volumetric analysis– Principles involved in acid- base, precipitation, complexometric and redox titrations – indicators and their choice.Definition and calculation of normality, molality, molarity, mole fraction and ppm. Definition and examples of primary and secondary standards. Calculation of equivalent weights of acid, base, salt, metal, oxidizing and reducing agents.

Qualitative analysis – theory behind separation of groups - solubility product - common ion effect - Interfering anions and their removal. Brown ring test, Nessler's reagent, Prussian blue-Detection of phosphate, borate, fluoride, oxalate and chloride.

(Lab safety rules – common laboratory hazards –MSDS; Fire extinguishers-types and uses – Chemical waste and safe disposal) *

UNIT V: Aromatic Hydrocarbons, Nucleophilic Substitution and Elimination Reactions (15 HOURS)

Aromaticity – Huckel's rule with respect to benzene, naphthalene, anthracene, phenanthraene-Electrophilic substitution in aromatic compounds-general mechanism; nitration, sulphonation, halogenations, Friedel-Crafts alkylation and acylation. Orientation (directive influence) and reactivity in mono substituted benzenes.

Polynuclear hydrocarbons-naphthalene, anthracene, phenanthraene - preparation, properties, uses and carcinogenicity. Nucleophilic substitution: S_N1, S_N2, S_Ni reactions-mechanisms. Elimination reactions: E1 and E2 reactions and mechanisms. Elimination Vs Substitution.

***Self-study – Not for End Semester Examination.**

PRESCRIBED BOOKS

1. M. K. Jain, S. C. Sharma, Modern Organic Chemistry, Vishal Publishing,fourth reprint, 2009.
2. P.S. Kalsi, Organic reactions and their Mechanism, New Academic Sciences, fifth edition,
3. 2021.
4. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone Publishers and Distributors, New Delhi, 33rd edition, 2019.
5. J.D. Lee, Concise Inorganic Chemistry, Blackwell Science, fifth edition, 2014.
6. P.L. Soni and Mohan Katyal, Textbook of Inorganic Chemistry, Sultan Chand & Sons, twentieth edition, 2017.

REFERENCE BOOKS:

1. Arun Bahl and B.S. Bahl, Advanced Organic Chemistry, S.Chand & CompanyPvt. Ltd., Multicolour edition, 2012.
2. T.W. Graham Solomons, Organic Chemistry, John Wiley & Sons, eleventh edition,2012.
3. R.T. Morrison and R.N. Boyd, Organic Chemistry, Pearson Education, Asia, seventh edition, 2012.
4. O.P. Agarwal, Organic Chemistry Reactions and Reagents, Goel Publishing house,2005.

E-LEARNING RESOURCES:

1. www.epgpathshala.nic.in
2. www.nptel.ac.in
3. http:/swayam.gov.in
4. Virtual Textbook of Organic Chemistry

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions(each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions(each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions(each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS FOR THEORY

UNIT	SECTION A		SECTION B		SECTION C
	Theory	**Problem**	**Theory**	**Problem**	
I	3		1	1	2
II	2	1	1		1
III	2		1		1
IV	1	1	2		1
V	2		1		1
TOTAL	**12**		**7**		**6**

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
Ave.	3	3	3	3	3

PSO-CO-question paper mapping

CO No.	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	To demonstrate the concepts related to nuclear structure, stability of the nuclei, nuclear isomers, nuclear reaction, different modes of radioactive decay and nuclear reactor.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO2	To predict the elements of symmetry and to explain the type of defects in crystals	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO3	To acquire knowledge about preparation, important chemical properties and uses of hydrocarbons and poly nuclear hydrocarbons.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO4	To gain an understanding of principles of quantitative, qualitative analysis and to conduct the experiments.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO5	To understand the reaction mechanism in aromatic and aliphatic compounds, types of reaction, to understand the orientation and reactivity in substituted benzene.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

PROGRAMME: B. Sc.	**BATCH:** 2024-27
PART: IV	**COURSE COMPONENT:** NON MAJOR ELECTIVE
COURSE NAME: Dairy Chemistry	**COURSE CODE:**
SEMESTER: I/II	**MARKS:**100
CREDITS: 2	**TOTAL HOURS:** 30
THEORY	

COURSE OBJECTIVE:

To learn the chemistry of milk and milk products and also the processes involved in the preservation and formation of milk products.

COURSE OUTCOMES:

1. Understand about general composition of milk – constituents and its physical properties.
2. Acquire knowledge about pasteurization of Milk and various types of pasteurization - Bottle, Batch and HTST Ultra High Temperature Pasteurization.
3. Learn about Cream and Butter their composition and how to estimate fat in cream and Ghee
4. Explain about Homogenized milk, flavoured milk, vitaminised milk and toned milk.
5. Understand about how to make milk powder and its drying process - types of drying process

UNIT I: Composition of Milk (6 HOURS)

Milk - definition - general composition of milk - constituents of milk - lipids,proteins, carbohydrates, vitamins and minerals - physical properties of milk - colour, odour, acidity, specific gravity, viscosity and conductivity - Factors affecting the composition of milk - adulterants, preservatives with neutralizer - examples and their detection - estimation of fat, acidity and total solids in milk.

UNIT II: Processing of Milk (6 HOURS)

Microbiology of milk - destruction of micro - organisms in milk, physico - chemical changes taking place in milk due to processing - boiling, pasteurization - types of pasteurization - Bottle, Batch and HTST (High Temperature Short Time) - Vacuum pasteurization - Ultra High Temperature Pasteurization.

UNIT III: Major Milk Products (6 HOURS)

Cream - definition - composition - chemistry of creaming process - gravitational and centrifugal methods of separation of cream - estimation of fat in cream. Butter - definition - composition - theory of churning – desi butter - salted butter, estimation of acidity and moisture

content in butter. Ghee - major constituents - common adulterants added to ghee andtheir detection - rancidity - definition - prevention - antioxidants and synergists - natural and synthetic.

UNIT IV: Special Milk (6 HOURS)

Standardised milk - definition - merits - reconstituted milk - definition - flow diagram of manufacture - Homogenised milk - flavoured milk - vitaminised milk - toned milk - Incitation milk - Vegetable toned milk - humanized milk - condensed milk - definition, composition and nutritive value.

UNIT V: Fermented and other Milk Products (6 HOURS)

Fermented milk products - fermentation of milk - definition, conditions, cultured milk - definition of culture - example, conditions - cultured cream, butter milk - Bulgaricus milk - acidophilous milk –Indigenous products - khoa and chhena definition - Ice cream - definition - percentage composition - types - ingredients - manufacture of ice – cream stabilizers - emulsifiers and their role - milk powder - definition - need for making milkpowder - drying process - types of drying.

PRESCRIBED BOOKS:

1. K. Bagavathi Sundari, Applied Chemistry, MJP Publishers, first edition, 2006.
2. K. S. Rangappa and K.T. Acharya, Indian Dairy Products, Asia Publishing House, New Delhi, 1974.

REFERENCE BOOKS:

1. Robert Jenness and S. Patom, Principles of Dairy Chemistry, S.Wiley, New York, 2005.
2. F.P. Wond, Fundamentals of Dairy Chemistry, Springer, Singapore, 2006.
3. Sukumar De, Outlines of Dairy Technology, Oxford University Press, New Delhi, 1980.
4. P.F.Fox and P.L.H. Mcsweeney, Dairy Chemistry and Biochemistry,Springer, Second edition, 2016.

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	2	2	3
CO 2	3	3	2	3	3
CO 3	3	3	2	2	2
CO 4	3	3	3	2	2
CO 5	3	3	3	3	2
Ave.	3	3	2.4	2.4	2.4

PSO-CO-question paper mapping

CO No.	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	To understand about general composition of milk – constitutents and its physical properties.	PSO 1, PSO 2	K1, K2, K3.
CO2	To acquire knowledge about pasteurization of Milk and various types of pasteurization - Bottle, Batch and HTST Ultra High Temperature Pasteurization.	PSO 1, PSO 2, PSO4, PSO 5.	K1, K2, K3.
CO3	To learn about Cream and Butter their composition and how to estimate fat in cream and Ghee	PSO 1, PSO 2.	K1, K2, K3.
CO4	To explain about Homogenized milk , flavoured milk, vitaminised milk and toned milk .	PSO 1, PSO 2, PSO 3.	K1, K2, K3.
CO5	To have an idea about how to make milk powder and its drying process - types of drying process	PSO 1, PSO 2, PSO 3, PSO4.	K1, K2, K3.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

PROGRAMME: B. Sc.	**BATCH:** 2024-27
PART: IV	**COURSE COMPONENT:** NON MAJOR ELECTIVE
COURSE NAME: Food Chemistry	**COURSE CODE:**
SEMESTER: I/II	**MARKS:**100
CREDITS: 2	**TOTAL HOURS:** 30
THEORY	

COURSE OBJECTIVE:

To create knowledge on chemistry of various food products, adulteration and toxicology.

COURSE OUTCOMES:

1. Detect the food adulteration - contamination of Wheat, Rice, Milk, Butter.
2. Get an awareness about food poisons like natural poisons (alkaloids - nephrotoxin) pesticides, DDT, BHC, Malathion.
3. Get an exposure on food additives, artificial sweeteners, Saccharin, cyclamate and Aspartate in the food industries.
4. Acquire knowledge on beverages, soft drinks, soda, fruit juices and alcoholic beverages.
5. Understand the chemistry of fats and oils - Sources of oils - production of refined vegetable oils - preservation. Saturated and unsaturated fats –MUFA and PUFA.

UNIT I: Food Adulteration (6 HOURS)

Sources of food, types, advantages and disadvantages. Food adulteration - contamination of wheat, rice, milk, butter etc. with clay stones, water and toxic chemicals - Common adulterants, Ghee adulterants and their detection. Detection of adulterated foods bysimple analytical techniques.

UNIT II: Food Poison (6 HOURS)

Food poisons - natural poisons (alkaloids - nephrotoxin) - pesticides, (DDT, BHC, Malathion) - Chemical poisons - First aid for poison consumed victims.

UNIT III: Food Additives (6 HOURS)

Food additives - artificial sweeteners - Saccharin - Cyclomate and Aspartate – disadvantages of artificial sweeteners. Food flavours - esters, aldehydes and heterocyclic compounds-Food colours – Emulsifying agents – preservatives - leavening agents. Baking powder - yeast - taste makers – MSG- vinegar.

UNIT IV: Beverages (6 HOURS)

Beverages - soft drinks - soda - fruit juices - alcoholic beverages. Carbonation - addiction to alcohol – diseases of liver and social problems.

UNIT V: Edible Oils **(6 HOURS)**

Fats and oils - Sources of oils - production of refined vegetable oils - preservation. Saturated and unsaturated fats - iodine value - role of MUFA and PUFA in preventing heart diseases - determination of iodine value, RM value, saponification values and their significance.

PRESCRIBED BOOKS:

1. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010.
2. Jayashree Ghosh, Fundamental Concepts of Applied Chemistry, S. Chand & Co.Publishers, second edition, 2006.
3. Hasenhuettl, Gerard. L.; Hartel, Richard. W. Food Emulsifiers and Their Applications Springer New York 2nd ed. 2008.

REFERENCE BOOKS:

1. H.-D. Belitz, Werner Grosch,, Food Chemistry Springer Science & Business Media, 4th Edition, 2009.
2. M. Swaminathan, Food Science and Experimental Foods, Ganesh and Company, 1979.Thanlamma Jacob, Text Books of Applied Chemistry for Home Science and Allied Sciences, Macmillan, 1979.

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	3	3	3
CO 2	3	3	2	3	3
CO 3	3	3	2	3	3
CO 4	3	3	2	2	2
CO 5	3	3	3	3	3
Ave.	3	3	2.4	2.8	2.8

PSO-CO-question paper mapping

CO No.	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	To detect the food adulteration - contamination of Wheat, Rice, Milk, Butter.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO2	To get an awareness about food poisons like natural poisons (alkaloids - nephrotoxin) pesticides, DDT, BHC, Malathion	PSO 1, PSO 2, PSO4, PSO 5.	K1, K2, K3, K4.
CO3	To get an exposure on food additives, artificial sweetners, Saccharin, Cyclomate and Aspartate in the food industries.	PSO 1, PSO 2, PSO4, PSO 5.	K1, K2, K3, K4.
CO4	To acquire knowledge on beverages, soft drinks, soda, fruit juices and alcoholic beverages.	PSO 1, PSO 2.	K1, K2, K3, K4.
CO5	To understand the chemistry of fats and oils - Sources of oils - production of refined vegetable oils - preservation. Saturated and unsaturated fats – MUFA and PUFA	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

PROGRAMME: B. Sc.	**BATCH:** 2024-27
PART: IV	**COURSE COMPONENT:** NON MAJOR ELECTIVE
COURSE NAME: Forensic Chemistry	**COURSE CODE:**
SEMESTER: I/II	**MARKS:**100
CREDITS: 2	**TOTAL HOURS:** 30
THEORY	

COURSE OBJECTIVE:

To deliver knowledge on chemistry involved in the forensic science.

COURSE OUTCOMES:

1. Explain the types of poisons and its classifications.
2. Understand the differences between Human bombs explosives (gelatin sticks and RDX) and to describe he components of metal defector devices and other security measures for VVIP - composition of bullets and detecting powder burns.
3. Detect the documents forgery's, different types of forged signatures.
4. Acquire the knowledge about how to tracks and trace using police dogs, foot prints identification and gain the knowledge in analyzing biological substances.
5. Get the awareness on Aids - causes and prevention and also have an exposure on handling fire explodes.

UNIT I: Poisons (6 HOURS)

Poisons - types and classification - diagnosis of poisons in the living and the dead - clinical symptoms - postmortem appearances. Heavy metal contamination (Hg, Pb, Cd) of sea foods Treatment in cases of poisoning - use of antidotes for common poisons.

UNIT II: Crime Detection (6 HOURS)

Accidental explosion during manufacture of matches and fireworks (as in Sivakasi). Human bombs - possible explosives (gelatin sticks and RDX) - metal detector devices and other security measures for VVIP - composition of bullets and detecting powder burns.

UNIT III: Forgery and Counterfeiting (6 HOURS)

Documents - different types of forged signatures - simulated and traced forgeries - inherent signs of forgery methods - writing deliberately modified - uses of ultraviolet rays - comparison of type written letters – checking silver line water mark in currency notes - alloy analysis using AAS to detect counterfeit coins - detection of gold purity in 22 carat ornaments - detecting gold plated jewels - authenticity of diamond.

UNIT IV: Tracks and Traces **(6 HOURS)**

Tracks and traces - small tracks and police dogs - foot prints - costing of foot prints - residue prints, walking pattern or tyre marks - miscellaneous traces and tracks - glass fracture - tool marks - paints - fibers - Analysis of biological substances - blood, semen, saliva, urine and hair - Cranial analysis (head and teeth) DNA Finger printing for tissue identification in dismembered bodies - detecting steroid consumption in athletes and race horses.

UNIT V: Fire investigation and explosives **(6 HOURS)**

Arson - natural fires and arson - burning characteristics and chemistry of combustible materials - nature of combustion. Ballistics - classification - internal and terminal ballistics - small arms -laboratory examination of barrel washing and detection of powder residue by chemical tests.

PRESCRIBED BOOKS:

1. SA Iqbal, M Liviu, Textbook of forensic chemistry, Discovery publishing house private limited, 2011.
2. Kelly M. Elkins, Introduction to Forensic Chemistry, CRC Press, Taylor & Francis Group, 2019.
3. JaVed I. Khan, Thomas J. Kennedy, Donnell R. Christian, Jr., Basic principles of Forensic chemistry, Humana Press, first edition, 2012.

REFERENCE BOOKS:

1. Richard Saferstin and Criminalistics - An Introduction to Forensic Science(College Version), Sopfestein, Printice hall, eighth edition, 2003
2. Suzanne Bell, Forensic Chemistry, Pearson, second international edition, 2014.
3. Jay Siegel, Forensic chemistry: Fundamentals and applications, Wiley-Blackwell, first edition, 2015.

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	2	3	3
CO 2	3	3	2	3	2
CO 3	3	3	3	3	2
CO 4	3	3	3	3	3
CO 5	3	3	2	3	2
Ave.	3	3	2.4	2.4	2.4

PSO-CO-question paper mapping

CO No.	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	To explain the types of poisons and its classifications	PSO 1, PSO 2, PSO4, PSO 5.	K1, K2, K3, K4.
CO2	To understand the differences between Human bombs explosives (gelatin sticks and RDX) and to describe he components of metal defector devices and other security measures for VVIP - composition of bullets and detecting powder burns	PSO 1, PSO 2, PSO4.	K1, K2, K3, K4.
CO3	To detect the documents forgery's, different types of forged signatures	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO4	To have an idea about how to tracks and trace using police dogs, foot prints identification and gain the knowledge in analyzing biological substances	PSO 1, PSO 2, PSO 3, PSO4.	K1, K2, K3, K4.
CO5	To get the awareness on Aids - causes and prevention and also have an exposure on handling fire explodes.	PSO 1, PSO 2, PSO4.	K1, K2, K3, K4.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

PROGRAMME: B. Sc.	**BATCH:** 2024-27
PART: IV	**COURSE COMPONENT:** NON MAJOR ELECTIVE
COURSE NAME: Role of Chemistry in Daily Life	**COURSE CODE:**
SEMESTER: I/II	**MARKS:**100
CREDITS: 2	**TOTAL HOURS:** 30
THEORY	

COURSE OBJECTIVE:

To learn chemistry involved in our day-by-day life.

COURSE OUTCOMES:

1. Learn about the chemicals used in everyday life as well as air pollution and water pollution.
2. Get knowledge on building materials cement, ceramics, glass and Plastics, polythene, PVC, bakelite, polyesters.
3. Acquire information about food and nutrition. Carbohydrates, proteins, fats also have an awareness about cosmetics, tooth pastes, face powder, soaps and detergents.
4. Discuss about the fertilizers like urea, NPK fertilizers and super phosphate. Fuel classification solid, liquid and gaseous; nuclear fuel - examples and uses
5. Have an idea about the Pharmaceutical drugs analgesics and antipyretics like paracetamol and aspirin and also about pigments and dyes and its applications.

UNIT I: **(6 HOURS)**

General survey of chemicals used in everyday life. Air - components and their importance; photosynthetic reaction, air pollution, green - house effect and the impact on our life style. Water - Sources of water, qualities of potable water, soft and hard water, methods of removal of hardness – zeolite process, demineralization process - water pollution.

UNIT II: **(6 HOURS)**

Building materials - cement, ceramics, glass and refractories - definition, compositionand application only. Plastics - polythene, PVC, bakelite, polyesters, melamine- formaldehyde resins - preparation and uses only.

UNIT III: **(6 HOURS)**

Food and Nutrition - Carbohydrates, Proteins, Fats - definition and their importance asfood constituents - balanced diet - Calorie - minerals and vitamins (sources and their physiological

importance). Cosmetics - tooth paste, face powder, soaps and detergents, shampoos, nail polish, perfumes - general formulation - possible hazards of cosmetic use.

UNIT IV: (6 HOURS)

Chemicals in food production - fertilizers - need, natural sources; urea, NPK fertilizers and super phosphate. Fuel - classification - solid, liquid and gaseous; nuclear fuel examples and uses.

UNIT V: (6 HOURS)

Pharmaceutical drugs - analgesics and antipyretics - paracetamol and aspirin. Colour chemicals - pigments and dyes - examples and applications. Explosives - classification and examples.

PRESCRIBED BOOKS:

1. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010.
2. A textbook of pharmaceutical chemistry by Jayashree Ghosh, S Chand publishing, 2012.
3. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.
4. B. K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.

REFERENCE BOOKS:

1. Himanshu J Patel, Handbook for Chemical Process Industries, CRC Press, first edition, 2023.
2. W. A. Poucher, Joseph A. Brink, Jr. Perfumes, Cosmetics and Soaps, Springer, 2000.
3. A. K. De, Environmental Chemistry, New Age International Public Co., 1990.

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO5
CO 1	3	3	2	2	3
CO 2	3	3	2	3	3
CO 3	3	3	2	2	2
CO 4	3	3	3	2	2
CO 5	3	3	3	3	2
Ave.	3	3	2.4	2.4	2.4

PSO-CO-question paper mapping

CO No.	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	To learn about the chemicals used in everyday life as well as air pollution and water pollution.	PSO 1, PSO 2, PSO 5.	K1, K2, K3,K4.
CO2	To get knowledge on building materials cement, ceramics, glass and Plastics, polythene, PVC, bakelite, polyesters,	PSO 1, PSO 2, PSO4, PSO 5.	K1, K2, K3,K4.
CO3	To acquire information about food and nutrition. Carbohydrates, proteins, fats also have an awareness about cosmetics, tooth pastes, face powder, soaps and detergents,.	PSO 1, PSO 2.	K1, K2, K3,K4.
CO4	To discuss about the fertilizers like urea, NPK fertilizers and super phosphate. Fuel classification solid, liquid and gaseous; nuclear fuel - examples and uses	PSO 1, PSO 2, PSO 3.	K1, K2, K3,K4.
CO5	To have an idea about the Pharmaceutical drugs analgesics and antipyretics like paracetamol and aspirin and also about pigments and dyes and its applications.	PSO 1, PSO 2, PSO 3, PSO4.	K1, K2, K3,K4.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

PROGRAMME: B. Sc. CHEMISTRY	**BATCH:** 2024-27
PART: IV	**COURSE COMPONENT:** SOFT SKILL -2
COURSE NAME: INTERVIEW SKILLS AND RESUME WRITING	**COURSE CODE:**
SEMESTER: II	**MARKS:**100
CREDITS: 2	**TOTAL HOURS:** 30
THEORY	

COURSE OBJECTIVE:

To equip the students to acquire the relevant skills for better employability.

COURSE OUTCOMES:

1. Gain an overall understanding of the concept, the purpose, and the objectives of an interview
2. Aware of the various types of interviews and the nuances of each one of them
3. Students will understand and equip themselves with the techniques and strategies required to ace an interview
4. Able to draft a biodata /CV/Resume in the proper format
5. Embark on acquiring the relevant skills and will learn to leverage them effectively for better employability

UNIT I: Introduction to Interview Skills (6 Hours)

Definition- meaning- concept of interview –Purpose- Objectives of interview- Characteristic features of job interviews.

UNIT II: Types of Interview (6 Hours)

Traditional one on one job interview- Panel interview- Behavioral interview-Group interview- Phone Interview- Preliminary Interview-Patterned Interview Depth Interview, Stress Interview, Exit Interview- Interview through tele and video conferencing.

UNIT III: Interviews: Techniques and Strategies (6 Hours)

Preparing for the Interview Process- Before the interview-During the interview-After the interview

-Tips to ace an interview -Commonly asked questions in interview -Do's and Don'ts of interview - Reasons for rejections.

UNIT IV: Preparing Biodata/CV/Resume (6 Hours)

Essential characteristics of a job Application-Difference between Biodata- CV-Resume-covering letter-Tips to draft an application.

UNIT V: Leveraging Employability Skills (6 Hours)

Personality Development-Organizational skills-Time Management–Stress Management-Effective Communication Skills -Reasoning Ability-Verbal Ability- Group Discussion-Technical skills - Presentation skills.

PRESCRIBED TEXTBOOKS

1. Monipally, Matthukutty M. (2017) *Business Communication: From Principles to Practice*
2. Peter, Francis. (2012) *Soft Skills and Professional Communication*. New Delhi: Tata McGraw Hill.

REFERENCE BOOKS

1. Higgins, Jessica JD (2018)*10 Skills for Effective Business Communication: Practical Strategies from the World's Greatest Leaders*
2. Nicholas, Sonji (2023) *Interviewing: Preparation, Types, Techniques, and Questions,* Pressbooks
3. Storey, James (2016) *The Art of The Interview: The Perfect Answers to Every Interview Question*

E-LEARNING RESOURCES

1. https://careermobilityoffice.cs.ny.gov/cmo/documents/Resume%20&%20Interviewing%20Handou t.pdf
2. https://edu.gcfglobal.org/en/interviewingskills/interview-etiquette/1/
3. https://findjobhub.com/en/types-of-interviews
4. https://egyankosh.ac.in/bitstream/123456789/23411/1/Unit-2.pdf
5. https://bharatskills.gov.in/pdf/E_Books/CTS/ES/English/ES_Part_1_62%20hour_English.pdf
6. https://bharatskills.gov.in/pdf/E_Books/CTS/ES/English/ES_Part2_58hour_English.pdf

SEMESTER - III

PROGRAMME: B. Sc. CHEMISTRY	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** CORE-IV
COURSE NAME: ORGANO OXYGEN COMPOUNDS	**COURSE CODE:**
SEMESTER: III	**MARKS:**100
CREDITS: 4	**TOTAL HOURS:** 75
THEORY	

COURSE OBJECTIVE:

To acquire knowledge about organo oxygen compounds.

COURSE OUTCOMES:

1. Gain knowledge about highly essential organic functionalities and deal about their structure, nomenclature and reactivity - alcohols, ethers and phenol.
2. Propose the mechanism for enolization reaction, nucleophilic addition and reduction reactions of aldehydes and ketones
3. Compare the acidity of carboxylic acids, effect of substituents on acidity, acid derivatives, relative reactivity of acyl derivatives.
4. Understand the characteristics of active methylene compounds and its applications in organic synthesis.
5. Gain knowledge on carbohydrates-mono saccharides, concept of mutarotation, conformation and configuration of glucose, evidence for furanose and pyranose structure, interconversion of sugars, disaccharides and polysaccharides.

UNIT I: Chemistry of alcohols, ethers and phenols (15 HOURS)

` Monohydric alcohols: Nomenclature, preparation of alcohols from alkenes (by oxymercuration -demercuration), alkyl halides, Grignard reagent and carbonyl compounds(by reduction). Reactions of alcohols- Dehydration, oxidation, action of hot reduced copper.

Ethers: Nomenclature, preparation by Williamson ether synthesis, Reactions-acid catalysed cleavage of ethers. Epoxides (Oxirane) - preparation and reactions of epoxides.

Phenols: Nomenclature, types, synthesis of phenol from benzene sulphonic acid, chloro benzene and cumene. Properties – Acidity of phenols (explanation on the basis of resonance stabilization). Electrophilic substitution reaction of phenol (orientation of electrophiles) - halogenation, nitration, sulphonation, Riemer-Tiemann reaction, Kolbe-Schmidt reaction and coupling with diazonium salts.

UNIT II: Chemistry of carbonyl compounds (15 HOURS)

Nomenclature, structure of carbonyl compounds, acidity of alpha-hydrogen atom. Mechanism of nucleophilic addition with RMgX, HCN, ROH, $NaHSO_3$, NH_3 and its derivatives.

Mechanism of Meerwein-Pondorf-Verley reduction, Clemmensen reduction, Wolf- Kishner reduction, aldol condensation, Claisen-Schmidt reaction, Cannizaro reaction, haloform reaction, Knoevenagel, Perkin and Benzoin condensation reactions.

UNIT III: Chemistry of carboxylic acids and their derivatives (15 HOURS)

Acidity of carboxylic acids, effect of substituents on acidity, comparison of acidstrengths of halogen substituted acetic acids, acid strengths of substituted benzoic acids. Dicarboxylic acids: Preparation – from alkyl cyanides, cyclic ketones and haloesters. Reactions – action of heat, action of PCl_5 and NH_3. Acid derivatives (Aliphatic): Synthesis and important properties of acid derivatives (acid chlorides, acid anhydrides, esters and amides). Relative reactivity of acyl compounds.

UNIT IV: Active methylene compounds (15 HOURS)

Active methylene compounds - keto-enol tautomerism. Compounds containing active methylene group- acetoacetic, malonic and cyanoacetic esters. Preparation and synthetic applications.

UNIT V: Carbohydrates (15 HOURS)

Carbohydrates – Definition and classification of carbohydrates with examples. Mono saccharides: Explanation of enantiomers, diastereomers, epimers and anomers with examples. Mechanism of mutarotation, Osazone formation.

Absolute configurations of glucose and fructose (includes cyclic and Haworth structure). Interconversion (aldose to ketose, ketose to aldose, arabinose to glucose, glucose to arabinose and glucose to mannose). Disaccharides – Sucrose, Maltose – structural elucidation. Polysaccharides - Starch and cellulose (Elementary treatment)

PRESCRIBED BOOKS:

1. M. K. Jain, S. C. Sharma, Modern Organic Chemistry, Vishal Publishing, Fourth reprint, 2009.
2. P. L. Soni, and H. M.Chawla - Text Book of Organic Chemistry, New Delhi, Sultan Chand & Sons, Twenty ninth Edition, 2007.
3. S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, Macmillan India Ltd., Reprint, 2009.
4. Arun Bahl and B.S. Bahl, Advanced organic chemistry, New Delhi, S.Chand & Company Pvt. Ltd., Multicolour Edition, 2012.
5. R. T. Morrison, R. N. Boyd, and S. N. Bhattacharjee, Organic Chemistry, Pearson Education, Asia, Seventh Edition, 2012.

REFERENCE BOOKS:

1. T. W. Graham Solomons, Organic Chemistry, John Wiley & Sons, Twelfth Edition, 2017.
2. A. Carey Francis Organic Chemistry, Tata McGraw-Hill Education Pvt., Ltd., New Delhi, Seventh Edition, 2007.
3.I. L. Finar, Organic Chemistry, Wesley Longman Ltd, England, Sixth Edition, 2006.

E-LEARNING RESOURCES:

1. www.epgpathshala.nic.in
2. www.nptel.ac.in
3. http:/swayam.gov.in
4. Virtual Textbook of Organic Chemistry
5. https://vlab.amrita.edu/

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions(each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions(each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions(each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS FOR THEORY

UNIT	SECTION A	SECTION B	SECTION C
I	3	2	2
II	3	1	1
III	2	1	1
IV	2	2	1
V	2	1	1
TOTAL	**12**	**7**	**6**

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	2	3	2	3
CO 2	3	3	3	2	3
CO 3	3	3	3	2	3
CO 4	3	3	2	2	3
CO 5	3	2	3	2	3
Ave.	3	2.6	2.8	2	3

PSO-CO-question paper mapping

CO No.	**COURSE OUTCOME**	**PSOs ADDRESSED**	**COGNITIVE LEVEL (K1 to K6)**
CO1	To gain knowledge about highly essential organic functionalities and deal about their structure, nomenclature and reactivity -alcohols, ethers and phenol .	PSO 1, PSO 3, PSO 5.	K1, K2, K3, K4.
CO2	To propose the mechanism for enolization reaction, nucleophilic addition and reduction reactions of aldehydes and ketones	PSO 1, PSO 2, PSO 3, PSO 5.	K1, K2, K3, K4.
CO3	To compare the acidity of carboxylic acids, effect of substituents on acidity, acid derivatives, relative reactivity of acyl derivatives.	PSO 1, PSO 2, PSO 3, PSO 5.	K1, K2, K3, K4.
CO4	To understand the characteristics of active methylene compounds and its applications in organic synthesis.	PSO 1, PSO 2, PSO 5.	K1, K2, K3, K4.
CO5	To gain knowledge on carbohydrates-mono saccharides, concept of mutarotation, conformation and configuration of glucose, evidence for furanose and pyranose structure, interconversion of sugars, disaccharides and polysaccharides.	PSO 1, PSO 3, PSO 5.	K1, K2, K3, K4.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

PROGRAMME: B. Sc. CHEMISTRY	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** CORE-V
COURSE NAME: INORGANIC QUALITATIVE ANALYSIS	**COURSE CODE:**
SEMESTER: III/IV	**MARKS:**100
CREDITS: 3	**TOTAL HOURS:** 45
PRACTICAL	

COURSE OBJECTIVE:

To develop the skill on systematic analysis of inorganic salts.

COURSE OUTCOMES:

On completion of the course the students will be able

1 Acquire knowledge on the systematic analysis of mixture of inorganic salts

2 Understand the chemistry of interfering radicals

3 Analyze the acid and basic radicals in the unknown substance using the standard laboratory procedures.

4 Identify the acid and basic radicals in the soil and water and to test the quality of water.

5 Conduct inorganic qualitative analysis by following the safe laboratory practices

Semi - Micro Qualitative Analysis

1. Analysis of simple acid radicals:

   Carbonate, sulphide, sulphate, chloride, bromide, iodide, nitrate

2. Analysis of interfering acid radicals:

   Fluoride, oxalate, borate, phosphate.

3. Elimination of interfering acid radicals and Identifying the group of basic radicals

4. Analysis of basic radicals (group wise):

   Lead, copper, bismuth, cadmium, tin, antimony, iron, aluminium, zinc,manganese, nickel, cobalt, calcium, strontium, barium, magnesium, ammonium

5. Analysis of a mixture - I to VIII containing two cations and two anions(of which one is interfering type)

REFERENCE BOOKS:

1 . V. Venkateswaran, R. Veeraswamy and A. R. Kulandivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, Second Edition, 2017.

2. A.L. Vogel, Text book of Inorganic quantitative analysis, ELBS, Third Edition, 1976.

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
Ave.	3	3	3	3	3

PROGRAMME: UG (For All Non IT students)	**BATCH:** 2024-2027
PART: IV	**COURSE COMPONENT:** SOFT SKILL- 3
COURSE NAME: DIGITAL PROFICIENCY AND MULTIMEDIA SKILLS	**COURSE CODE:**
SEMESTER: III	**MARKS:**100
CREDITS: 2	**TOTAL HOURS:** 30
PRACTICAL	

COURSE OBJECTIVE:

To equip students with essential computing skills.

COURSE OUTCOMES:

1. Design document using salient features of MS-Word.
2. Utilize MS-Excel to manipulate data and prepare dynamic presentation using MS-Power Point.
3. Develop a static web page using HTML.
4. Exhibit proficiency in multimedia creation using GIMP.
5. Demonstrate expertise in data visualization with Raw Graphs.

Unit I: (6 Hours)

MS-Word: Creating, Editing, Formatting and Printing of Documents - Headers and Footers -Spell check- Insert/Draw Tables, Table Auto format – Page Borders and Shading - Mail Merge.

MS-Excel: Creating a new worksheet – Entering, editing and formatting the text, numbers – Formatting cells.

Unit II: (6 Hours)

Inserting Rows/Columns - Changing column widths and row heights – Freezing Titles, splitting screen - Formulae for calculation - Changing font sizes and colours, Sort.

MS-PowerPoint: Creating a Presentation - Inserting and Deleting Slides in a Presentation – Adding Text/Clip Art/Pictures - Slide Transition – Custom Animation.

Unit III: (6 Hours)

Web designing using HTML: Basic tags – heading tags – paragraph, bold, italic, underline tags – font tags – ordered and unordered list – inserting images – hyperlinks.

Unit IV: (6 Hours)

Multimedia applications using GIMP: Interface and Drawing Tools in GIMP- Applying Filters Creating and handling multiple layers - Using Stamping and Smudging tools - Importing pictures.

Unit V: (6 Hours)

Data visualization using Raw Graphs: Importing and exploring data - Basic chart types -mapping - customizing visualizations - Exporting visualizations.

E-LEARNING RESOURCES:

1. https://www.javatpoint.com/ms-word-tutorial
2. https://www.w3schools.com/excel/
3. https://www.tutorialspoint.com/html/
4. https://www.gimp.org/tutorials/
5. https://www.rawgraphs.io/learning

SEMESTER - IV

PROGRAMME: B. Sc. CHEMISTRY	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** CORE-VI
COURSE NAME: CHEMISTRY OF 's' AND 'p' BLOCK ELEMENTS	**COURSE CODE:**
SEMESTER: IV	**MARKS:**100
CREDITS: 4	**TOTAL HOURS:** 75
THEORY	

COURSE OBJECTIVE:

To know the nature of compounds formed by s - and p - block elements; to understandthe aspects in gaseous, liquid and solid states; to understand the crystal structures of ionic compounds.

COURSE OUTCOMES:

1. Acquire knowledge about the characteristics of s and p block elements, periodic trends and diagonal relationship between elements. .
2. Gain knowledge about the extraction of s and p block elements
3. Explain the preparation, properties and industrial applications of compounds such as hydrides, carbides, oxy acids of phosphorous, sulphur, nitrogen and haloacids
4. Interpret and recognize the geometry of various inorganic compounds.
5. Know the position of noble gases in the periodic table, structure and bonding of noble gas halides.

UNIT I: Chemistry of s-block elements (15 HOURS)

Characteristic properties of s-block elements, preparation, properties and uses of NaOH, Na_2CO_3, KBr and $KClO_3$. Hydrides – Classification as ionic, molecular and metallic hydrides, preparation, important properties and uses of $NaBH_4$, $LiAlH_4$ and CaH_2. Comparative studyof the element with respect to oxides, hydroxides, halides, carbonates and bicarbonates. Diagonal relationship of Li and Mg. Anomalous behavior of Li and Be. Extraction ofberyllium. Chemical properties of metals: reaction with water, air and nitrogen.

UNIT II: Boron and Carbon family (15 HOURS)

Extraction of B and Si - Compounds of boron with oxygen - preparation, properties and uses of boron sesquioxide, borates, borax, sodium peroxoborates. - Compounds of Boron with nitrogen - preparation, properties and uses of boron nitride, borazine. Boron hydrides - preparation, properties, uses and structure of diborane, reaction with ammonia, hydroboration.

Aluminium - Extraction of Aluminium and its uses, Alloys of Aluminium, amphoteric behavior, aluminates. Comparison of carbon with silicon; allotropy of carbon and carbides.

Preparation, types and industrial applications of carbides, interstitial carbides and covalent carbides.

Silicates - Types of silicates – application of silicates in technology - alkali silicates, ceramics and glass. Preparation, properties and uses of silicones. Tin – Allotropic forms of Tin, alloys of tin, tinning, tin plating, lead pigments.

UNIT III: Nitrogen and Oxygen Group Elements (15 HOURS)

Metallic and non-metallic character of group 15 elements; hydrides and halides of group-15 elements - hydrazine, hydroxylamine, phosphene, ammonium nitrate, sodium bismuthate - properties and uses. Oxides of group 15 elements: oxides of nitrogen - dinitrogen tetroxide, dinitrogen pentoxide; oxides of phosphorus - oxoacids of nitrogen: nitrous acid, nitric acid, hyponitrous acid; oxoacids of phosphorus - orthophosphorous acid, metaphosphorous acid, hypophosphorous acid; orthophosphoric acid, di-, tri- and tetra polyphosphoric acids;

Group-16 (oxygen group): Ozone, oxides - normal oxides, peroxides, suboxides, basic oxides, amphoteric oxides, acidic oxides, neutral oxides. Oxides of sulphur - SO_2, SO_3; oxoacids of sulphur - thionic acid series, peroxoacid series, oxohalides - thionyl compounds, sulfuryl compounds (methods of preparation and properties).

UNIT IV: Halogens (15 HOURS)

Ionic – covalent - bridging halides, reactivity of halogens, Halogen oxides: oxygen difluoride, dioxygen difluoride, dichlorine monoxide, chlorine dioxide, dichlorine hexoxide, dichlorine heptoxide; bleaching powder - estimation ofavailable chlorine; bromine dioxide, iodine pentoxide. Oxoacids of halogens: hypohalous acid (HOX), halous acid (HXO_2), halic oxide (HXO_3), perhalic acid (HXO_4), strength of oxoacids. Inter-halogen compounds: ClF, ICl, ClF_3, BrF_3, IF_3, ClF_5, BrF_5, IF_5; poly halides.

UNIT V: Noble Gases (15 HOURS)

Noble gases: position in the periodic table – general characteristics – structure and shape of Xenon compounds – XeF_2, XeF_4, XeF_6, $XeOF_4$ – uses of Noble gases. Chemical reactivity of noble gases, preparation, structure and bonding of noble gas compounds. Chemistry of xenon: structure and bonding of xenon fluorides, - oxides and oxyfluorides of xenon.

PRESCRIBED BOOKS:

1. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone publishers, New Delhi, 33rd Edition, 2019.
2. P.L. Soni and Mohan katyal, Textbook of Inorganic Chemistry, Sultan Chand & Sons,Twentieth Edition, 2017.
3. J.D. Lee, Concise Inorganic Chemistry, Wiley Blackwell science, Fifth Edition, 2014.
4. R.D. Madan, Modern Inorganic Chemistry, S Chand Publishing, 2019.

REFERENCE BOOKS:

1. K. De, Text book of Inorganic Chemistry, New age publishers; Ninth Edition,2018.
2. Wahid U Malik, G. D.Tuli and R. D. Madan, Selected Topics in Inorganic Chemistry S. Chand and Co, Nineteenth Edition, 2014.
3. R. C. Agrawal, Modern Inorganic Chemistry, Kitab Mahal, 2005.
4. Peter Atkins, Tina Overton, Jonathan Rourke and Mark Weller, Inorganic Chemistry, Oxford University Press, Sixth Edition, 2014.

E-LEARNING RESOURCES:

1. www.epgpathshala.nic.in
2. www.nptel.ac.in
3. http:/swayam.gov.in

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions(each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions(each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions(each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS FOR THEORY

UNIT	SECTION A	SECTION B	SECTION C
I	3	2	2
II	3	1	1
III	2	1	1
IV	2	2	1
V	2	1	1
TOTAL	**12**	**7**	**6**

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
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CO 2	3	2	3	2	3
CO 3	3	2	3	2	3
CO 4	3	2	3	2	3
CO 5	3	2	3	2	3
Ave.	3	2	3	2	3

PSO-CO-question paper mapping

CO No.	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	To acquire knowledge about the characteristics of s and p block elements, periodic trends and diagonal relationship between elements	PSO 1, PSO 3, PSO 5.	K1, K2, K3, K4.
CO2	To gain knowledge about the extraction of s and p block elements	PSO 1, PSO 3, PSO 5.	K1, K2, K3, K4.
CO3	To explain the preparation, properties and industrial applications of compounds such as hydrides, carbides, oxy acids of phosphorous, sulphur, nitrogen and haloacids	PSO 1, PSO 3, PSO 5.	K1, K2, K3, K4.
CO4	To interpret and recognize the geometry of various inorganic compounds	PSO 1, PSO 3, PSO 5.	K1, K2, K3, K4.
CO5	To know the position of noble gases in the periodic table, structure and bonding of noble gas halides	PSO 1, PSO 3, PSO 5.	K1, K2, K3, K4.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

PROGRAMME: B. Sc. CHEMISTRY	**BATCH:** 2024 - 27
PART: IV	**COURSE COMPONENT:** EVS
COURSE NAME: ENVIRONMENTAL STUDIES	**COURSE CODE:**
SEMESTER: IV	**MARKS:**100
CREDITS: 2	**TOTAL HOURS:** 30
THEORY	

UNIT-1:
The Multidisciplinary nature of environmental studies Definition; Scope and importance, Need for public awareness.

UNIT-2: Natural Resources
Renewable and non-renewable resources: Natural resources and associated problems.
(a) Forest resources: Use and Over-exploitation, deforestation, case studies. Timber extraction, mining, dams and their effects on forests and tribal people.
(b) Water resources: Use and over-utilization of surface and ground water, floods, drought, conflicts over water dams benefits and problems.
(c) Mineral resources: Use and exploitation, environmental effects of extracting and using mineral resources, case studies.
(d) Food resources: World food problems, changes caused by agriculture and overgrazing, effects of modern agriculture, fertilizer-pesticide problems, water logging, salinity, case studies.
(e) Energy resources: Growing energy needs, renewable and non-renewable energy sources, use of alternate energy sources, Case studies.
(f) Land resources: Land as a resource, land degradation, man induced landslides, soil erosion and desertification. - Role of an individual in conservation of natural resources. - Equitable use of resources for sustainable lifestyles.

UNIT-3: Ecosystems
Concept of an ecosystem. - Structure and function of an ecosystem. - Producers, consumers and decomposers. - Energy flow in the ecosystem.
- Ecological succession. - Food chains, food webs and ecological pyramids. - Introduction, types, characteristic features, structure and function of the following ecosystem: -
(a) Forest ecosystem
(b) Grassland ecosystem
(c) Desert ecosystem
(d) Aquatic ecosystems (ponds, streams, lakes, rivers, oceans, estuaries)

UNIT-4: Biodiversity and its Conservation
(a) Introduction-Definition: genetic, species and ecosystem diversity.
(b) Biogeographical classification of India.
(c) Value of biodiversity: consumptive use, productive use, social, ethical, aesthetic and option values.
(d) Biodiversity at global, National and local levels.
(e) India as a mega-diversity nation.
(f) Hot-spots of biodiversity.
(g) Threats to biodiversity: habitat loss, poaching of wildlife, man-wildlife conflicts.
(h) Endangered and endemic species of India.

(i) Conservation of biodiversity: In-situ and Ex-situ conservation of biodiversity.

UNIT-5: Environmental Pollution

Definition - Causes, effects and control measures of:

(a) Air pollution
(b) Water pollution
(c) Soil pollution
(d) Marine pollution
(e) Noise pollution
(f) Thermal pollution
(g) Nuclear hazards

Solid waste Management: Causes, effects and control measures of urban and industrial wastes. - Role of an individual in prevention of pollution. - Pollution case studies. Disaster management: floods, earthquake, cyclone and landslides.

UNIT-6: Social Issues and the Environment

(a) From Unsustainable to Sustainable development.
(b) Urban problems related to energy. - Water conservation, rain water harvesting, watershed management.
(c) Resettlement and rehabilitation of people; its problems and concerns. Case studies.
(d) Environmental ethics: Issues and possible solutions.
(e) Climate change, global warming, acid rain, ozone layer depletion, nuclear accidents and holocaust. Case studies.
(f) Wasteland reclamation.
(g) Consumerism and waste products.
(h) Environment Protection Act.
(i) Air (Prevention and Control of Pollution) Act.
(j) Water (Prevention and Control of Pollution) Act.
(k) Wildlife Protection Act.
(l) Forest Conservation Act.
(m) Issues involved in enforcement of environmental legislation.
(n) Public awareness.

UNIT-7: Human Population and the Environment

(a) Population growth, variation among nations.
(b) Population Explosion-Family welfare Programme.
(c) Environment and human health.
(d) Human Rights.
(e) Value Education.
(f) HIV/AIDS.
(g) Women and Child Welfare.
(h) Role of information Technology in Environment and human health.
(i) Case Studies. UNIT-8: Field Work (Practical).
(j) Visit to a local area to document environmental assets-river/forest/grassland/ hill/mountain.
(k) Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.
(l) Study of common plants, insects, birds.
(m) Study of simple ecosystems-pond, river, hill slopes, etc.

UNIT-8: Field Work (Practical)

(a)Visit to a local area to document environmental assets-river/forest/grassland/ hill/mountain.

(b)Visit to a local polluted site-Urban/Rural/Industrial/Agricultural.

(c) Study of common plants, insects, birds.

(d) Study of simple ecosystems-pond, river, hill slopes, etc.

PROGRAMME: B. Sc. CHEMISTRY	**BATCH:** 2024 - 2027
PART: IV	**COURSE COMPONENT:** SOFT SKILL- 4
COURSE NAME: FOUNDATIONS OF QUANTITATIVE APTITUDE	**COURSE CODE:**
SEMESTER: IV	**MARKS:**100
CREDITS: 2	**TOTAL HOURS:** 30
THEORY AND PROBLEMS	

COURSE OBJECTIVE:

To develop learners' problem-solving skills and critical thinking abilities in the context of recruitment aptitude tests.

COURSE OUTCOMES:

1. Recognize, describe and represent patterns and relationships, as well as to solve problems using algebraic language and skills.
2. Learn about factors and multiples that numbers have in common with each other.
3. Analyse monthly profit and loss statements for a school store and calculate profit margin percentages
4. Learn what different types of interest are, where it occurs in real life and understand the concept of simple and compound interests.
5. Draw, interpret and compare pie charts, bar charts and frequency diagrams.

Unit I: Number system and Number series (6 Hours)

Numbers: Numbers and their classification, test for divisibility of numbers, General properties of divisibility, division and remainder, remainder rules.
Number Series: Number series, three steps to solve a problem on series, two-line number series, sum rules on natural numbers.

Unit II: HCF and LCM of Numbers (6 Hours)

Factors, Multiples, Principal of Prime factorization, Highest Common Factor (HCF) and Least Common Multiple (LCM), Product of two numbers, Difference between HCF and LCM.

Unit III: Percentage, Profit and Loss (6 Hours)

Percentage: Introduction, fraction to rate percent, rate percent to fraction, rate percent of a number, express a given quantity as a percentage of another given quantity, convert a percentage into decimals and convert a decimal into percentage.
Profit and Loss: Gain/Loss and % gain and % loss, relation among Cost price, Sale price, Gain/Loss and % gain and % loss.

Unit IV: Simple Interest and Compound Interest (6 Hours)
Simple Interest: Definition, effect of change of *P, R and T* on Simple Interest, amount.
Compound Interest: Introduction, conversion period, basic formula, to find the Principal / Rate / Time, Difference between Simple Interest and Compound Interest.

Unit V: Data interpretation **(6 Hours)**

Tabulation, Bar Graphs, Pie Charts, Line Graphs, average.

PRESCRIBED BOOK:

Quantitative Aptitude by R.S. Agarwal

REFERENCE BOOKS:

1. Quantitative Aptitude by Abhijit Guha, Fourth Edition.
2. Quantitative Aptitude by Ramandeep Singh.

E - LEARNING RESOURCES:

1. https://byjus.com/maths/numeral-system/#:~:text=crore%20is%207.-,International%20Numeral%20System,8%20%E2%80%93%20Ones
2. https://byjus.com/maths/hcf-and-lcm/
3. https://byjus.com/maths/profit-loss-percentage/
4. https://www.vedantu.com/jee-main/maths-difference-between-simple-interest-and-compound-interest
5. https://sites.utexas.edu/sos/guided/descriptive/descriptivec/frequency/

SEMESTER - V

PROGRAMME: B. Sc. CHEMISTRY	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** CORE-VII
COURSE NAME: ORGANO NITROGEN COMPOUNDS AND NATURAL PRODUCTS	**COURSE CODE:**
SEMESTER: V	**MARKS:**100
CREDITS: 4	**TOTAL HOURS:** 60
THEORY	

COURSE OBJECTIVE:

To introduce chemistry of nitrogen compounds and natural products namely amino acids, proteins and alkaloids.

COURSE OUTCOMES:

1. Explain the methods of preparation of amines, diazonium compounds and nitro compounds.
2. Understand the classification, preparation, properties of amino acids, structures of proteins and their reactions.
3. Gain knowledge about RNA, DNA, their structure, preparation and properties of five and six membered heterocyclic compounds.
4. Classify the type of alkaloids and to demonstrate their preparation, properties and structural elucidation.
5. Elucidate the structures of terpenoids like citral, menthol, α-pinene and camphor.

UNIT I: Amines, Diazonium Compounds and Nitro Compounds (15 HOURS)

Aliphatic and aromatic amines: Preparation of primary, secondary and tertiary amines. Reactions: basicity of amines, effect of substituent on basicity of aromatic amines. sulpha drugs, Diazonium salts: Preparation, diazotization reactions, replacement reactions (Sandmeyer, Gatterman and Gomberg reactions), coupling reactions.

Nitro compounds: Nomenclature and classification, aliphatic and aromatic nitro compounds, general properties, preparation by nitration. Reactions: reduction by chemicaland electrolytic methods. Di- and tri- substitution of aromatic nitro compounds: synthesis of o- , m- , p-dinitrobenzenes and trinitrobenzene.

UNIT II: Amino acids and Proteins (15 HOURS)

Classification, structure and stereochemistry of amino acids, Acid - base behavior isoelectric point and electrophoresis, preparation and reactions of α - amino acids, structure and nomenclature of peptides and proteins, classification of proteins, peptide structure determination, end group analysis, selective hydrolysis of peptides, classical peptide synthesis, solid - phase peptide synthesis, Structure of peptides and proteins, Protein denaturation / renaturation.

UNIT III: Nucleic acids and Heterocyclic Compounds (10 HOURS)

Introduction, constituents of nucleic acids, nucleosides and nucleotides. The double helical structure of DNA. Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution, mechanism of nucleophilic substitution reaction in pyridine derivatives, comparison of basicity of pyridine, piperidine and pyrrole.

Introduction to condensed five and six membered heterocycles. Preparation and reactions of indole, quinoline and isoquinoline with special references to Fisher indole synthesis, Skraup synthesis, Bischler-Napieralski synthesis. Electrophilic substitution reactions mechanism of indole, quinoline and isoquinoline.

UNIT IV: Alkaloids (10 HOURS)

Alkaloids: Definition, Occurrence, extraction of alkaloids from plants, general properties, determination of the chemical constitution of the alkaloids, functional groupanalysis, estimation of groups, degradation and synthesis. Structural elucidation of Coniine, Piperine and Nicotine.

UNIT V: Terpenoids (10 HOURS)

Terpenoids: Classification, isoprene rule, special isoprene rule, isolation and general properties, occurrence,structural elucidation of geraniol, citral, menthol, α - pinene and camphor.

PRESCRIBED BOOKS:

1. M. K. Jain, S. C. Sharma, Modern Organic Chemistry, Vishal Publishing, Golden jubilee year Edition, 2020.
2. S.M. Mukherji, and S.P. Singh, Reaction Mechanism in Organic Chemistry, MacmillanIndia Ltd., Third Edition, 2009.
3. Arun Bahl and B.S. Bahl, Advanced organic chemistry, New Delhi, S.Chand & Company Pvt. Ltd., Multicolour Edition, 2012.
4. P. L.Soni and H. M. Chawla, Text Book of Organic Chemistry, Sultan Chand & Sons, New Delhi, Twenty ninth Edition, 2007.

REFERENCE BOOKS:

1. R. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson Education, Asia, Sixth Edition, 2012.
2. T.W. Graham Solomons, Organic Chemistry, John Wiley & Sons, Eleventh Edition, 2012.
3. A. Carey Francis, Organic Chemistry, Tata McGraw-Hill Education Pvt. Ltd., New Delhi,

Seventh Edition, 2009.

4. I. L. Finar, Organic Chemistry, Vol. (1& 2), England, Wesley Longman Ltd, Sixth Edition, 2006.
5. J. A. Joule, and G. F. Smith, Heterocyclic Chemistry, Wiley, Fifth Edition, 2010.

E-LEARNING RESOURCES:

1. www.epgpathshala.nic.in
2. www.nptel.ac.in
3. http:/swayam.gov.in
4. Virtual Textbook of Organic Chemistry
5. https://vlab.amrita.edu/

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions(each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions(each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions(each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS FOR THEORY

UNIT	SECTION A	SECTION B	SECTION C
I	3	2	2
II	3	1	1
III	2	1	1
IV	2	2	1
V	2	1	1
TOTAL	**12**	**7**	**6**

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	2	3
CO 2	3	3	3	2	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	2	3	3
Ave.	3	3	2.8	2.6	3

PSO-CO-question paper mapping

CO No.	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	To explain the methods of preparation of amines, diazonium compounds and nitro compounds.	PSO 1, PSO 2, PSO 3, PSO 5.	K1, K2, K3, K4.
CO2	To understand the classification, preparation, properties of amino acids, structures of proteins and their reactions.	PSO 1, PSO 2, PSO 3, PSO 5.	K1, K2, K3, K4.
CO3	To gain knowledge about RNA, DNA, their structure, preparation and properties of five and six membered heterocyclic compounds.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO4	To classify the type of alkaloids and to demonstrate their preparation, properties and structural elucidation.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO5	To elucidate the structures of terpenoids like citral, menthol, α-pinene and camphor.	PSO 1, PSO 2, PSO4, PSO 5.	K1, K2, K3, K4.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

PROGRAMME: B. Sc. CHEMISTRY	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** CORE- VIII
COURSE NAME: CHEMICAL KINETICS AND ELECTROCHEMISTRY	**COURSE CODE:**
SEMESTER: V	**MARKS:**100
CREDITS: 4	**TOTAL HOURS:** 60
THEORY	

COURSE OBJECTIVE:

To understand the concepts of kinetics of chemical reaction and electrochemistry.

COURSE OUTCOMES:

1 Study of rate and rate equation of a chemical reaction, determination of the rate constants and half-life of 0, 1 and 2 order from the data given.

2 Gain knowledge about the influence of temperature on reaction rates, collision theory and Lindemann's theory, Absolute reaction rate theory, catalyst, chemisorption and physisorption.

3 Understand the concept of conductivity and its determination, variation of specific and equivalent conductance on dilution, Kohlrausch's law, transport number, conductometric titration.

4 Study about electrochemical cell, construction, cell notation, reference electrodes, reversible cells, determining electrochemical potentials, spontaneity of cell reaction.

5 Acquire knowledge about concentration cell, cell potential, determination of pH using glass, quin hydrone electrode, electrochemical theory of corrosion and its prevention.

UNIT I: Chemical Kinetics – I **(10 HOURS)**

Rate of reaction - average and instantaneous rate - rate equation – order and molecularity - rate laws - rate constants - derivation of rate constants and characteristics of first, second, third and zero order reactions - derivation of time for half change with examples methods for determination of order of reaction – experimental methods of determination of rate constant of reactions – volumetry, manometry and polarimetry.

UNIT II: Chemical Kinetics – II **(15 HOURS)**

Effect of temperature on reaction rates - concept of activation energy - Arrhenius equation - Collision Theory - derivation of rate constant for bimolecular reactions - failure of collision theory - Lindemann's Theory of unimolecular reactions – theory of absolute reaction rates - derivation of rate constant for bimolecular reaction - significance of entropy and free energy of activation - comparison of collision theory and ARRT - consecutive, parallel and reversible reactions (no derivation, only examples)

Catalysis: Definition - characteristics of a catalyst - homogeneous and heterogeneous catalysis - function of a catalyst in terms of Gibb's free energy of activation - kinetics of acid-base and enzyme catalysis - heterogeneous catalysis - kinetics of unimolecular surface reactions.

Adsorption: Physisorption and chemisorption - Freundlich adsorption isotherm - Langmuir adsorption isotherm – applications of adsorption.

UNIT III: Electrical Conductance (15 HOURS)

Electrical transport, conductance in metal and in electrolytic solution. Specific conductance and equivalent conductance. Measurement of equivalent conductance usingKohlraush's bridge - Arrhenius theory of electrolytic dissociation and its limitation - Weak and strong electrolyte according to Arrhenius theory, Ostwald's dilution law - applications and limitation - Variation of equivalent conductance with concentration.

Migration of ion, ionic mobility. Kohlraush's law and its applications. Elementarytreatment of the Debye-Huckel-Onsager equation for strong electrolytes (No derivation), evidence for ionic atmosphere, the conductance at high fields (Wien effect) and high frequencies (Debye - Falkenhagen effect), Transport number and Hittorf rule. Determination by Hittorf method and moving boundary method. Application of conductance measurements - Determination of $\wedge o$ of strong electrolytes. Determination of K_a of weak acids. Determination of solubility product of a sparingly soluble salt, common ion effect and conductometric titrations.

UNIT IV: Electrochemical Cells – I (10 HOURS)

Electrolytic and Galvanic cells – Reversible and irreversible cells. Conventional representation of electrochemical cells. Electromotive force of a cell and its measurement - calculation of thermodynamic quantities of cell reactions (ΔG, ΔH, ΔS and K) - applicationof Gibbs-Helmholtz equation and Nernst equation.

Types of reversible electrodes – Gas/metal - metal ion/ metal - insoluble salt and redox electrodes. Electrode reactions – Nernst equation – Derivation of cell EMF and single electrode potential, standard hydrogen electrode – reference electrodes – standard electrode potentials – sign convention – Electrochemical series and its significance.

UNIT V: Electrochemical Cells – II (10 HOURS)

Concentration cell with and without transport - Liquid junction potential - Applicationof EMF concentration cells. Valence of ion, solubility product and activity co-efficient. Potentiometric

titrations. Determination of pH using hydrogen, quinhydrone and glass electrodes - Corrosion – types – passivity – prevention of corrosion. Batteries (Pb storage, Ni-Cd and Li). Fuel Cells: Basic principles - Hydrogen, oxygen fuel cells.

PRESCRIBED BOOKS:

1. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Shobanlal Nagin Chand and Co. Jalendhar, Forty Seventh edition, 2018.
2. R.L.Madan, Physical Chemistry McGraw Hill, 2015
3. K.L.Kapoor, A textbook of Physical Chemistry, Volume III, Mc Graw Hill, 2017
4. Bahl,A, Bahl,B.S.& Tuli, G.D., Essentials of Physical Chemistry, S.Chand, 27th Edition 2016.
5. S. K. Dogra and S. Dogra, Physical Chemistry through Problems: New Age International, Fourth Edition, 2015.
6. M.K. Bansal and M.K. Verma, Conceptual Physical Chemistry, Second Edition, 2017.

REFERENCE BOOKS:

1. Gilbert. W. Castellen, Physical Chemistry, Narosa Publishing House, Third Edition, 2004.
2. P. W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, Eleventh Edition, 2018.
3. K.J.Laidler, Chemical Kinetics.Harper and Row, Pearson Pvt. Ltd New York, Third Edition, 2011.

E-LEARNING RESOURCES:

1. www.epgpathshala.nic.in
2. www.nptel.ac.in
3. http:/swayam.gov.in

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions(each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions(each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions(each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS FOR THEORY

UNIT	SECTION A		SECTION B		SECTION C
	Theory	**Problem**	**Theory**	**Problem**	
I	2	1	1		2
II	3		1	1	1
III	1	1	2		1
IV	2		1		1
V	2		1		1
TOTAL	**12**		**7**		**6**

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	3	2
CO 2	3	3	3	3	2
CO 3	3	3	3	3	2
CO 4	3	3	3	3	2
CO 5	3	3	3	3	2
Ave.	3	3	3	3	2

PSO-CO-question paper mapping

CO No.	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	To study of rate and rate equation of a chemical reaction, determination of the rate constants and half-life of 0, 1 and 2 order from the data given.	PSO 1, PSO 2, PSO 3, PSO4.	K1, K2, K3.
CO2	To gain knowledge about the influence of temperature on reaction rates, collision theory and Lindemann's theory, Absolute reaction rate theory, catalyst, chemisorption and physisorption.	PSO 1, PSO 2, PSO 3, PSO4.	K1, K2, K3, K4.
CO3	To understand the concept of conductivity and its determination, variation of specific and equivalent conductance on dilution, Kohlrausch's law, transport number, conductometric titration.	PSO 1, PSO 2, PSO 3, PSO4.	K1, K2, K3.
CO4	To study about electrochemical cell, construction, cell notation, reference electrodes, reversible cells, determining electrochemical potentials, spontaneity of cell reaction.	PSO 1, PSO 2, PSO 3, PSO4.	K1, K2, K3, K4.
CO5	To acquire knowledge about concentration cell, cell potential, determination of pH using glass, quin hydrone electrode, electrochemical theory of corrosion and its prevention	PSO 1, PSO 2, PSO 3, PSO4.	K1, K2, K3, K4.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

PROGRAMME: B. Sc. CHEMISTRY	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** CORE- IX
COURSE NAME: SPECIAL TOPICS IN CHEMISTRY	**COURSE CODE:**
SEMESTER: V	**MARKS:**100
CREDITS: 4	**TOTAL HOURS:** 60
THEORY	

COURSE OBJECTIVE:

To emphasize the fundamentals of stereochemistry, group theory and photochemistry, molecular rearrangement and their applications.

COURSE OUTCOMES:

1 Explain the fundamentals of stereochemistry, visualize the various elements of symmetry, learn resolution, racemization and asymmetric synthesis.

2 Acquire knowledge about concept of flying, wedge, Newmann, Sawhorse and their interconversions, various nomenclature like d/l, D/L, erythro/threo, meso/dl, R-S, E-Z., conformational analysis of ethane and cyclohexane derivatives.

3 Gain knowledge about group theory by studying about symmetry elements, symmetry operations, point group, mathematical rule and group multiplication table for C_{2v}, C_{2h}, C_{3v} point groups.

4 Understand the basics of photochemistry, the laws of photochemistry, quantum efficiency and to study the kinetics of photochemical reactions between H_2 and Cl_2; H_2 and Br_2.

5 Predict and draw the types of rearrangement, reaction mechanism with the concept of migratory aptitudes, stereochemistry and their applications.

UNIT I: Stereochemistry – I **(10 HOURS)**

Stereoisomerism – classification; Optical isomerism – optical activity, specific rotation (calculation) – asymmetric center – chirality – achiral molecules. Elements of symmetry. Optical activity of biphenyls, allenes and spiranes. Racemisation – methods of racemisation (by substitution and tautomerism); resolution and methods of resolution (mechanical, biochemical and chemical). Asymmetric synthesis: Partial and absolute – Cram's rule (Elementary approach only).

UNIT II: Stereochemistry – II **(15 HOURS)**

Projection formula – flying wedge, Fischer, Sawhorse and Newmann – interconversion - d, l and D, L notations of optical isomers – Cahn-Ingold-Prelog rules – R and S nomenclature - optical isomers up to three chiral carbon atoms. Meso, dl, erythro and threo representations.

Geometrical isomerism – cis and trans, syn-anti and E-Z nomenclature. Geometrical isomerism in maleic, fumaric acids and unsymmetrical ketoximes. Methods of distinguishing geometrical isomers. Geometrical isomerism of disubstituted cyclohexanones.

Conformational analysis - conformers, configuration, dihedral angle and torsional strains. Conformational analysis of ethane and disubstituted ethane derivatives, conformers ofcyclohexane, bonds - ring flipping, mono and disubstituted cyclohexanes.

UNIT III: Group Theory (15 HOURS)

Symmetry elements and symmetry operations - symmetry operation of water molecule, illustration of mathematical rules for the group using symmetry operations of water molecule. Construction of group multiplication table for water and ammonia molecule. Point groups - definition. Symmetry elements and symmetry operations of the following groups – C_2, C_3, C_{2v}, C_{3v}, C_{2h} classes

UNIT IV: Photochemistry (10 HOURS)

Laws of photochemistry – Lambert - Beer's law – Grothus – Draper law and Stark Einstein law–Quantum efficiency –reasons for high and low quantum yield - comparison between thermal and photochemical reactions – rate law – kinetics of H_2 and Cl_2 ; H_2 and Br_2 reactions.

UNIT V: Molecular Rearrangements (10 HOURS)

Types of rearrangements - mechanism of pinacol-pinacolone, benzyl-benzilic acid, bezindine, Favorski, dienone- phenol, Claisen, Fries, Hoffmann, Curtius, Schmidt and Beckmann rearrangements.

PRESCRIBED BOOKS:

1. P.S. Kalsi, Stereochemistry, Conformation and Mechanism, New Academic Sciences, Tenth Edition, 2020.
2. R.T. Morrison, R.N. Boyd and S.K. Bhattacharjee, Organic chemistry, Pearson Prenticehall, Seventh Edition, 2012.
3. V.K.Ahluwalia, Rakesh Kumar Parashar, Organic Reaction Mechanisms, 4th Edition, 2009.
4. M. K. Jain, S. C. Sharma Modern Organic Chemistry, Vishal Publishers, Fourth Edition, 2009.
5. S. Swarnalakshmi, T. Saroja, R. M. Ezhilarasi; A Simple Approach to Group Theory in Chemistry Universities Press (India) Pvt. Ltd., First Edition, 2008.
6. B.R. Puri , L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Vishal Publishing Co., Forty Seventh Edition, 2019.

REFERENCE BOOKS:

1. P.S. Kalsi, Stereochemistry and Mechanism Through Solved Problems, New Age International Ltd, Fifth Edition, 2019.
2. P.S. Kalsi, Organic reactions and their Mechanism, New Academic Sciences, Fifth Edition, 2021.

3. P. W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, Eleventh Edition, 2018.

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions(each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions(each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions(each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS FOR THEORY

UNIT	SECTION A	SECTION B	SECTION C
I	3	2	2
II	3	1	1
III	2	1	1
IV	2	2	1
V	2	1	1
TOTAL	**12**	**7**	**6**

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	2	2	2	2
CO 2	2	2	2	2	2
CO 3	2	2	2	2	2
CO 4	3	3	3	2	3
CO 5	3	3	2	2	3
Ave.	2.4	2.4	2.2	2	2.4

PSO-CO-question paper mapping

CO No.	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	To explain the fundamentals of stereochemistry, visualize the various elements of symmetry, learn resolution, racemization and asymmetric synthesis.	PSO 1, PSO 2, PSO 3.	K1, K2, K3, K4, K5.
CO2	To acquire knowledge about concept of flying, wedge, Newmann, Sawhorse and their interconversions, various nomenclature like d/l, D/L, erythro/threo, meso/dl, R-S, E-Z., conformational analysis of ethane and cyclohexane derivatives.	PSO 1, PSO 2, PSO 3.	K1, K2, K3, K4, K5.
CO3	To gain knowledge about group theory by studying about symmetry elements, symmetry operations, point group, mathematical rule and group multiplication table for C_{2v}, C_{2h}, C_{3v} point groups.	PSO 1, PSO 2, PSO 3.	K1, K2, K3, K4, K5.
CO4	To understand the basics of photochemistry , the laws of photochemistry, quantum efficiency and to study the kinetics of photochemical reactions between H_2 and Cl_2; H_2 and Br_2.	PSO 1, PSO 2, PSO 3.	K1, K2, K3, K4, K5.
CO5	To predict and draw the types of rearrangement, reaction mechanism with the concept of migratory aptitudes, stereochemistry and their applications.	PSO 1, PSO 2, PSO 5.	K1, K2, K3, K4, K5.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

PROGRAMME: B. Sc. CHEMISTRY	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** CORE-X
COURSE NAME: ANALYTICAL CHEMISTRY-I	**COURSE CODE:**
SEMESTER: V	**MARKS:**100
CREDITS: 4	**TOTAL HOURS:** 60
THEORY	

COURSE OBJECTIVES:

To build a basic knowledge on fundamental chemical analysis and reporting of data.

COURSE OUTCOMES:

1 Develop a knowledge on generation of analytical data in an appropriate manner.

2 Acquire problem solving approach in chemical analysis.

3 Expertise a skill on microgram level chemical analysis using instrumental methods.

4 Develop the analytical skill in the structural identification of chemical compounds.

5 Gain knowledge in QC laboratory activities at ISO standard as part of chemical industries activities.

UNIT I: Data Analysis and Sampling (15 HOURS)

Precision, accuracy, theory of errors, idea of significant figures and its importance with examples, methods of expressing accuracy, error analysis, minimizing errors, methods of expressing precision, average, deviation, standard deviation and confidence limit; analytical balance; elementary aspect of calibration, calibration of glassware and other equipment for quantitative chemical analysis.

Sampling – Significance of sampling, types of sample, sampling methods for solids, liquids and gases.

UNIT II: Gravimetry (10 HOURS)

Gravimetric analysis – principle, precipitating agent, condition of precipitation; selective and specific precipitants–DMG, cupferron, salicylaldehyde, ethylenediamine; use ofsequestering agent, coprecipitation and post precipitation, peptisation, calculations in gravimetric method and gravimetric factor.

UNIT III: Separation Techniques (15 HOURS)

Separation by precipitation; solvent extraction–types and applications; Chromatographic techniques – types, principle, theory, instrumentation and applications of thin layer, paper

chromatography, column and ion–exchange chromatography; gas liquid chromatography and high performance liquid chromatography.

UNIT IV: Purification Techniques (10 HOURS)

Drying of solid, distillation–principle, types - simple distillation, fractional, steam, azeotrope and vacuum distillation; Soxhlet extraction, recrystallization, fractional crystallization, sublimation. Testing of purity – determination of melting point, boiling point, refractive index and density.

UNIT V: Polarimetry and Thermal analysis (10 HOURS)

Polarimetry – principle, instrumentation and applications; estimation of glucose.

Thermo–analytical methods: Principle involved in thermo gravimetric analysis and differential thermal analysis, discussion of various components with block diagram, characteristics of TGA and DTA – factors affecting TGA and DTA curves.

PRESCRIBED BOOKS:

1. R. Gopalan, K. Rengarajan, P. S. Subramanian, Elements of Analytical Chemistry,Sultan Chand & Sons, Third Edition, 2003.
2. David Harvey, Modern Analytical Chemistry, Tata McGraw-Hill, First Edition, 2000.
3. J. Mendham, R. C. Denney, J. D. Barnes and M. Thomas, Vogel's Text book of Quantitative Chemical Analysis, Pearson Education Pvt. Ltd, Sixth Edition, 2004.

REFERENCE BOOKS:

1. Douglas A. Skoog, Donald M. West and F. James Holler, Fundamentals of AnalyticalChemistry Harcourt Asia Pvt. Ltd., Ninth Edition, 2014.
2. Douglas A. Skoog, Donald M. West and F. James Holler, Analytical Chemistry, An Introduction; Saunders College Publishers, Seventh Edition, 2000.
3. Dean, John A. Merritt, Lynne L., Jr. Settle, Frank A., Jr. Willard, Hobart H, Instrumental Methods of Analysis, Wadsworth Publishing Co Inc., Seventh Edition, 1988.
4. Skoog D. A., Principles of Instrumental Analysis, Seventh Edition, 2016.

E-LEARNING RESOURCES:

1. www.epgpathshala.nic.in
2. www.nptel.ac.in

Visits to

1. Quality Control laboratories.
2. Various chemical industries with established laboratories.
3. BIS & FSSAI approved establishments.

GUIDELINES TO THE QUESTION PAPER SETTERS
QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions(each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions(each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions(each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS FOR THEORY

UNIT	SECTION A		SECTION B		SECTION C
	Theory	Problem	Theory	Problem	
I	3		1	1	2
II	2	1	1		1
III	2		1		1
IV	2		2		1
V	1	1	1		1
TOTAL	**12**		**7**		**6**

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	3	2
CO 2	3	3	3	3	2
CO 3	3	3	3	3	2
CO 4	3	3	3	3	2
CO 5	3	3	3	3	2
Ave.	3	3	3	3	2

PSO-CO-question paper mapping

CO No.	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	To develop a knowledge on generation of analytical data in an appropriate manner.	PSO 1, PSO 2, PSO 3, PSO4.	K1, K2, K3, K4.
CO2	To acquire problem solving approach in chemical analysis.	PSO 1, PSO 2, PSO 3, PSO4.	K1, K2, K3, K4.
CO3	To expertise a skill on microgram level chemical analysis using instrumental methods.	PSO 1, PSO 2, PSO 3, PSO4.	K1, K2, K3, K4.
CO4	To develop the analytical skill in the structural identification of chemical compounds.	PSO 1, PSO 2, PSO 3, PSO4.	K1, K2, K3, K4.
CO5	To gain knowledge in QC laboratory activities at ISO standard as part of chemical industries activities.	PSO 1, PSO 2, PSO 3, PSO4.	K1, K2, K3, K4.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

PROGRAMME: B. Sc. CHEMISTRY	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** CORE - XI
COURSE NAME: GRAVIMETRIC ANALYSIS	**COURSE CODE:**
SEMESTER: V & VI	**MARKS:**100
CREDITS: 4	**TOTAL HOURS:** 60
PRACTICAL	

COURSE OBJECTIVE:

To develop experimental skill in the gravimetric analysis of inorganic elements.

COURSE OUTCOMES:

1 Gain the knowledge in handling the crucibles (both sintered and silica crucible)
2 Understand the basic concepts of gravimetric estimation.
3 Estimate the amount of metal ions by gravimetry.
4 Identify and handle the hazardous chemicals safely by following the safe laboratory practices.
5 Carry out the qualitative and quantitative analysis of organic compounds which are the basis for the functioning of pharmaceutical industries.

Gravimetric Estimation:

1. Estimation of Lead as Lead chromate
2. Estimation of Barium as Barium chromate
3. Estimation of Nickel as Nickel-DMG complex
4. Estimation of Calcium as Calcium oxalate
5. Estimation of Barium as Barium sulfate
6. Estimation of sulfate as Barium sulfate
7. Estimation of lead in solder by gravimetry*
8. Estimation of Nickel from stainless steel*

(* For Internal assessment only)

REFERENCE BOOKS:

1. V.Venkateswaran, R.Veeraswamy and A.R. Kulandaivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, second edition, 1997.
2. B. S. Furniss, Vogel's Textbook of Practical Organic Chemistry, ELBS - Longman,London, seventh edition, 1984.

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
Ave.	3	3	3	3	3

PROGRAMME: B. Sc. CHEMISTRY	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** CORE-XII
COURSE NAME: ANALYSIS AND PREPARATION OF ORGANIC COMPOUNDS	**COURSE CODE:**
SEMESTER: V & VI	**MARKS:**100
CREDITS: 4	**TOTAL HOURS**: 60
PRACTICAL	

COURSE OBJECTIVE:

To exercise the laboratory skill on analysis of organic compounds and preparation of organic compounds.

COURSE OUTCOMES:

1 Understand different types of reaction (oxidation, reduction, esterification, acetylation, hydrolysis, bromination and nitration) and reagents used in the preparation of organic compounds

2 Calculate theoretical yield and percent yield of the reaction and maintain a detailed record notebook.

3 Identify the nature of organic compounds, special elements (N, S & halogen) functional group and prepare suitable derivatives.

4 Perform common laboratory techniques like reflux, distillation, recrystallization, vacuum filtration and thin-layer chromatography

5 Have an idea about R&D, synthetic chemistry labs in industry.

A. Organic Analysis

a) Qualitative analysis of simple organic compounds:

b) Confirmation by preparation of solids derivatives / characteristics colour reaction.

Note:

1. Mono - functional compounds are given for analysis. In the case of bi-functionalcompounds students are required to report any one of the functional groups.
2. Each student is expected to do the analysis of at least 12 different organic substances.

B. Organic Preparations and Chromatography Techniques

1. Preparation of Organic compounds involving the following chemical conversions (i).Oxidation (ii).Reduction (iii).Esterification (iv).Acetylation (v).Hydrolysis (vi).Nitration (vii).Bromination (viii).Diazotization (ix).Osazone formation.
2. Separation of chlorophyll from the plant extract by column chromatography*.
3. Identification of Food colorants by TLC.(* For Internal assessment only)

REFERENCE BOOKS:

1. V.Venkateswaran, R.Veeraswamy and A.R. Kulandaivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons,New Delhi, Second Edition, 1997.
2. B. S. Furniss, Vogel's Textbook of Practical Organic Chemistry, ELBS - Longman, London, Seventh Edition, 1984.

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
Ave.	3	3	3	3	3

PROGRAMME: B. Sc. CHEMISTRY	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** CORE - XIII
COURSE NAME: PHYSICAL CHEMISTRY PRACTICAL	**COURSE CODE:**
SEMESTER: V & VI	**MARKS:**100
CREDITS: 3	**TOTAL HOURS:** 45
PRACTICAL	

COURSE OBJECTIVE:

To perform the laboratory experiments in order to understand the concepts ofphysical changes in chemistry.

COURSE OUTCOMES:

1 Evaluate the kinetic study of ester hydrolysis and potassium iodide –persulphate system.

2 Find out CST of phenol–water system and effect of impurity (NaCl) in it.

3 Determine cryoscopic constant (Kf) of solvent and molecular mass of the solute and transition temperature of a salt hydrates.

4 Construct phase diagram and determine the eutectic composition and eutectic temperature of simple eutectic system.

5 Understand the principle of conductometric and potentiometric titration of strong acid against strong base.

List of Experiments

1. Determination of critical solution temperature of phenol –water system.
2. Study the effect of electrolyte on the critical solution temperature of phenol –water system.
3. Determination of transition temperature of salt hydrates by thermometric method.
4. Study of kinetics of acid catalyzed hydrolysis of ester by volumetric method.
5. Study of kinetics of the reaction between potassium persulphate and potassium iodide by volumetric method.
6. Determination of molar mass and K_f - Rast Method
7. Determination of eutectic temperature and eutectic composition of a simple eutectic system using phase diagram.
8. Conductometry: Acid - Base Titration
9. Potentiometry: Acid - Base Titration

REFERENCE BOOKS:

1. B.Viswanathan and P.S.Ragavan, Practiacl physical Chemistry, Published by Viva books, 2012.
2. B.D.Khosla, V.C. Garg and A. Khosla Senior Practical Physical chemistry, R.Chand & Co New Delhi, 2011.
3. P.S.Sindu, Practical Physical chemistry- A modern Approach, MacMillan India Ltd, First Edition, 2006.
4. C.W. Garland, J.W.Nibler and D.P. Shoemaker Experiments in Physical Chemistry,Tata McGraw-Hill, New York, Eighth Edition, 2003.
5. A.M. Halpern, G.C. McBane, Experiments in Physical Chemistry, W.H. Freeman , Co, New York. Third Edition, 2003.

6. V.Venkateswaran, R.Veeraswamy and A.R.Kulandaivelu, Basic Principles of Practical Chemistry, Sultan Chand & Sons, New Delhi, Second Edition, 2017.

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
Ave.	3	3	3	3	3

PROGRAMME: B. Sc. CHEMISTRY	**BATCH:** 2024 – 27
PART: IV	**COURSE COMPONENT:** VALUE EDUCATION
COURSE NAME: VALUE EDUCATION	**COURSE CODE:**
SEMESTER: IV	**MARKS:**100
CREDITS: 2	**TOTAL HOURS:** 30
THEORY	

UNIT 1: EDUCATION AND VALUES (6 Hours)

Definition, Concept, Classification, Theory, Criteria and Sources of values Aims and objectives of value education Role and Need for value education in the contemporary society, Role of education in transformation of values in society Role of parents, teachers, society, peer group and mass media in fostering values

UNIT 2: VALUE EDUCATION AND PERSONAL DEVELOPMENT (6 Hours)

Human Values: Truthfulness, Sacrifice, Sincerity, Self-Control, Altruism, Scientific Vision, relevancy of human values to good life. Character Formation towards Positive Personality
Modern challenges of adolescents: emotions and behavior Self-analysis and introspection: sensitization towards gender equality, differently abled, Respect for - age, experience, maturity, family members, neighbors, strangers, etc.

UNIT 3: HUMAN RIGHTS AND MARGINALIZED PEOPLE (6 Hours)

Concept of Human Rights – Principles of human rights – human rights and Indian constitution – Rights of Women and children – violence against women – Rights of marginalized People – like women, children, minorities, transgender, differently abled etc.

Social Issues and Communal Harmony Social issues – causes and magnitude - alcoholism, drug addiction, poverty, unemployment – communal harmony –concept –religion and its place in public domain –secular civil society

UNIT 4: VALUE EDUCATION TOWARDS NATIONAL AND GLOBAL DEVELOPMENT (6 Hours)

Constitutional Values :(Sovereign, Democracy, Socialism, Secularism, Equality, Justice, Liberty, Freedom, Fraternity)
Social Values: (Pity and Probity, Self-Control, Universal Brotherhood).
Professional Values :(Knowledge Thirst, Sincerity in Profession, Regularity, Punctuality, Faith).
Religious and Moral Values: (Tolerance, Wisdom, character).
Aesthetic Values: (Love and Appreciation of literature, fine arts)
Environmental Ethical Values
National Integration and international understanding.
Need of Humanistic value for espousing peace in society. Conflict of cross-cultural influences, cross-border education

UNIT 5: (6 Hours)

Guru Nanak Devji's Teachings
Relevance of Guru Nanak Devji's teachings' relevance to Modern Society
The Guru Granth Sahib
The five Ks
Values and beliefs

Rights and freedom (Right of equality, Right to Education, Right to Justice, Rights of women, Freedom of religion, Freedom of culture, Freedom of assembly, Freedom of speech)
Empowerment of women
Concept of Langar
Eminent Sikh personalities

REFERENCE BOOKS:

1. Dr. Abdul Kalam. My Journey-Transforming Dreams into Actions. Rupa Publications, 2013.
2. Steven R Covey, 8th Habit of Effective People (From Effectiveness to Greatness), Free Press, New York, 2005.
3. Prem Singh, G.J. (2004). 'Towards Value Based Education', University News. Vol. 42 (45): P.11-12.
4. V.R. Krishna Iyer. Dialectics & Dynamics of Human Rights in India (Tagore Law Lectures) The Yesterday, Today and Tomorrow, Eastern Law House **(**1999, Reprint 2018)
5. http://www.ncert.nic.in/rightside/links/pdf/framework/english/nf2005.pdf

SEMESTER - VI

PROGRAMME: B. Sc. CHEMISTRY	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** CORE- XIV
COURSE NAME: THERMODYNAMICS AND SOLUTIONS	**COURSE CODE:**
SEMESTER: VI	**MARKS:**100
CREDITS: 4	**TOTAL HOURS:** 60
THEORY	

COURSE OBJECTIVE:

To strengthen the knowledge on Thermodynamics and Solutions.

COURSE OUTCOMES:

1 Acquire knowledge about types of systems, thermodynamic processes and functions, first law of thermodynamic and application of Hess's law.
2 Know the different statements of second law of thermodynamics, spontaneity and apply to the solve problems and various concepts, calculate the entropy change of physical transformations
3 Understand Nernst heat theorem, third law of thermodynamics and derive Vant Hoff reaction and isotherm
4 Describe different types of solution, ideal and non-ideal behaviours solutions - binary liquid mixtures, CST, azeotropes, colligative properties and its application
5 Gain knowledge of phase rule, draw and interpret the phase diagram of one and two component systems, system with congruent and incongruent melting point and its application.

UNIT I: Thermodynamics I **(15 HOURS)**

Definition and explanation of terms - System –surrounding - open, closed and isolated systems - state of system - intensive and extensive properties - Thermodynamic equilibrium - Thermodynamic processes - isothermal, adiabatic, reversible, irreversible and cyclic processes - state and path functions - exact and inexact differentials - concept of heat and work - work of expansion at constant pressure and free expansion.

First law of Thermodynamics - statement and equation - definition of internal energy(U), Enthalpy(H) and heat capacity - relation between C_p and C_v - Calculation of W, q, ΔU and ΔH for expansion of ideal gases under reversible isothermal and adiabatic conditions Joule - Thomson effect - Calculation of μ_{JT} for ideal and real gases - inversion temperature and its significance. Thermo chemistry - Relation between enthalpy of reaction at constant volume (q_v) and at constant pressure(q_p), variation of enthalpy of reaction with temperature - Kirchhoff's equation - enthalpy of combustion - flame and explosion temperature - heat of neutralization - heat of formation - integral heat of solution and dilution - Bond energy and itscalculation from thermo chemical data - Hess's law and its applications.

UNIT II: Thermodynamics II **(10 HOURS)**

Second law of Thermodynamics - need for second law - different statements ofsecond law - spontaneous process - concept of entropy – definition - entropy of an ideal gas - entropy changes in reversible, cyclic and physical transformations - physical significance of entropy - calculation of entropy changes with changes in P, V, T and entropy of mixing - Entropy criterion for spontaneous and equilibrium processes - Gibb's free energy(G) and Helmholtz free energy (A) – variation of G and A with P, V and T - Criteria for Spontaneity -Gibb's - Helmholtz equation and its applications.

UNIT III: Thermodynamics III **(10 HOURS)**

Third law of Thermodynamics - Nernst heat theorem - statement of third law of Thermodynamics - determination of absolute entropy from heat capacity measurements - exceptions to third law.

Thermodynamic treatment of law of mass action – van't Hoff reaction isotherm - Standard free energy change with equilibrium constant - Variation of equilibrium constant with temperature change - van't Hoff isotherm. Partial molar properties – Basic concept of Chemical potential - fugacity, activity and activity coefficient– Clapeyron-Clausius equation -derivation and its uses.

UNIT IV: Solutions **(15 HOURS)**

Ideal and non - ideal solutions - solutions of liquids in liquids - Raoult's law - binary liquid mixtures - deviations from ideal behaviour - vapour pressure – composition and vapourpressure - temperature curves - azeotropic distillation – Ethanol-water system and HCl-Water system - partially miscible liquid systems - phenol - water system, triethylamine - water, Nicotine - water system - effect of impurities on CST - completely immiscible liquids - steamdistillation - solutions of gases in liquids - Henry's law.

Dilute solutions: Colligative properties - relative lowering of vapour pressure - thermodynamic derivation of elevation of boiling point - depression of freezing point – calculation of molecular weight – osmosis - laws of osmotic pressure- distribution law - thermodynamic derivation and application.

UNIT V: Phase Equilibria **(10 HOURS)**

Definition of terms in phase rule – derivation and application to one component system - water and sulphur – super cooling, sublimation. Two component systems – Solid liquid equilibria, simple eutectic lead – silver (desilverisation of lead), Bi-Cd; compound formation with congruent melting point (Mg - Zn, $FeCl_3$ – H_2O) and incongruent melting point (Na - K, Na_2SO_4 - H_2O).

PRESCRIBED BOOKS:

1. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, Shobanlal Nagin Chand and Co. Jalundhar, Forty Seventh Edition, 2018.
2. R.L.Madan, Physical Chemistry McGraw Hill, 2015.
3. K.L.Kapoor, A textbook of Physical Chemistry, Volume III, Mc Graw Hill, 2017.
4. Bahl,A, Bahl,B.S.& Tuli, G.D., Essentials of Physical Chemistry, S.Chand, 27th Edition 2016.
5. K. Dogra and S. Dogra, Physical Chemistry through Problems: New Age International, Fourth Edition, 2015.
6. M.K. Bansal and M.K. Verma, Conceptual Physical Chemistry, Second Edition, 2017.

REFERENCE BOOKS:

1. Gilbert. W. Castellen, Physical Chemistry, Narosa Publishing House, Third Edition, 2004.
2. P. W. Atkins, and Julio de Paula, Physical Chemistry, Oxford University press, Eleventh Edition, 2018.
3. K.J.Laidler, Chemical Kinetics.Harper and Row, Pearson Pvt. Ltd New York, Third Edition, 2011.
4. Rajaram and J.C. Kuriacose, Thermodynamics, Shoban Lal Nagin Chand and Co. ,2006.

E-LEARNING RESOURCES:

1. www.epgpathshala.nic.in
2. www.nptel.ac.in
3. http:/swayam.gov.in

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions(each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions(each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions(each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS FOR THEORY

UNIT	SECTION A		SECTION B		SECTION C
	Theory	**Problem**	**Theory**	**Problem**	
I	3		1	1	2
II	2	1	1		1
III	2		1		1
IV	2		1	1	1
V	2		1		1
TOTAL	**12**		**7**		**6**

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	2	3	2	3
CO 2	3	2	3	2	3
CO 3	3	2	2	2	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
Ave.	3	2.4	2.8	2.4	3

PSO-CO-question paper mapping

CO No.	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	To acquire knowledge about types of systems, thermodynamic processes and functions, first law of thermodynamic and application of Hess's law.	PSO 1, PSO 3, PSO 5.	K1, K2, K3, K4, K5.
CO2	To know the different statements of second law of thermodynamics, spontaneity and apply to the solve problems and various concepts, calculate the entropy change of physical transformations	PSO 1, PSO 3, PSO 5.	K1, K2, K3, K4, K5.
CO3	To understand Nernst heat theorem, third law of thermodynamics and derive Vant Hoff reaction and isotherm	PSO 1, PSO 5.	K1, K2, K3, K4, K5.
CO4	To describe different types of solution, ideal and non-ideal behaviours solutions - binary liquid mixtures, CST, azeotropes, colligative properties and its application	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4, K5.
CO5	To gain knowledge of phase rule, draw and interpret the phase diagram of one and two component systems, system with congruent and incongruent melting point and its application.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4, K5.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

PROGRAMME: B. Sc. CHEMISTRY	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** CORE-XV
COURSE NAME: CHEMISTRY OF 'd' AND 'f' BLOCK ELEMENTS AND COORDINATION CHEMISTRY	**COURSE CODE:**
SEMESTER: VI	**MARKS:**100
CREDITS: 4	**TOTAL HOURS:** 60
THEORY	

COURSE OBJECTIVE:

To learn the chemistry of elements, present in the d- and f-blocks of periodic table.

COURSE OUTCOMES:

1 Understand the chemistry of transition and inner transition elements.
2 Acquire knowledge about the metal present in the ore and its benign extraction procedures.
3 Predict the IUPAC nomenclature and isomerism of coordination complexes.
4 Explain the magnetic property and color of the complexes by applying the theories related to coordination compounds.
5 Gain knowledge of reaction mechanism in coordination compounds and biological importance of transition metals

UNIT I: Chemistry of d-block elements (15 HOURS)

Characteristic properties of d-block elements: magnetic property, reactivity, variable oxidation states, catalytic properties, comparative study of the elements of the first transition series with reference to size, ionization potentials, redox potentials, magnetic behaviour, oxidation states and ability to form complex compounds, trends in chemical and physical properties in passing from first to second and third series; important uses of transition metals and their alloys. Extraction of Ti, V, W, Cr.

UNIT II: Chemistry of f-Block Elements (10 HOURS)

General characteristics of f-block elements- Lanthanides: lanthanide contraction, similarity in properties, occurrence, oxidation states, chemical properties of Ln(III) cations, magnetic properties. Separation of lanthanides: solvent extraction, ion exchange.

Actinides: occurrence, oxidation states, magnetic properties. Extraction of Uranium and thorium. Preparation, properties and uses of ceric ammonium sulphate, thorium dioxide, thorium nitrate, uranium hexafluoride, uranyl acetate. Comparison of lanthanides and actinides.

UNIT III: Coordination Chemistry I (15 HOURS)

Review of the fundamentals of coordination chemistry: Distinction between double salts and coordination compounds - Terminology, types of ligands - monodentate, bidentate, polydentate and ambidendate ligands, IUPAC rules for nomenclature of coordination compounds, applications of complexes in qualitative and quantitative analysis.

Isomerism: linkage, ionization, hydrate, coordination, coordination position isomerism, geometrical (cis and trans; facial and meridional), optical isomerism in 4 - coordinated and 6-coordinated complexes, trans effect, stability of coordination compounds –overall and step wise stability constants. Factors affecting the stability of complexes.

UNIT IV: Coordination Chemistry II (10 HOURS)

Werner's coordination theory, Sidgwick theory - EAN rule and stability, valence bond theory, 4-coordinate complexes, 6-coordinate complexes - Inner and outer orbital complexes, hybridization, geometry, magnetism, limitations of VBT. Crystal field theory: crystal field effects, crystal field splitting in octahedral, tetragonally distorted octahedral geometry,tetrahedral geometries and square planar complexes - high spin and low spin complexes; CFSE and factors affecting it; computation of CFSE; spectrochemical series.

UNIT V: Reaction Mechanisms, synthesis and biological importance of Coordination Compounds (10 HOURS)

Substitution reactions in octahedral complexes and square planar complexes: dissociative and associative and interchange mechanisms (simple approach). Cis- and trans- effects in synthesis of square planar and octahedral complexes. Biological importance of transition metals: Cr, Mo, Mn, Fe, Co, Cu, Zn.

PRESCRIBED BOOKS:

1. B.R. Puri, L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Milestone publishers, New Delhi, 33rd Edition, 2019.
2. P.L. Soni and Mohan katyal, Textbook of Inorganic Chemistry, Sultan Chand & Sons, Twentieth Edition, 2017.
3. J.D. Lee, Concise Inorganic Chemistry, Wiley Blackwell science, Fifth Edition, 2014.
4. R.D. Madan, Modern Inorganic Chemistry, S Chand Publishing, 2019.

REFERENCE BOOKS:

1. K. De, Text book of Inorganic Chemistry, New age publishers; Ninth Edition, 2018.
2. Wahid U Malik, G. D.Tuli and R. D. Madan, Selected Topics in Inorganic Chemistry, S. Chand and Co, Nineteenth Edition, 2014.
3. R. C. Agrawal, Modern Inorganic Chemistry, Kitab Mahal, 2005.

E-LEARNING RESOURCES:

1. www.epgpathshala.nic.in
2. www.nptel.ac.in
3. http:/swayam.gov.in
4. Virtual Textbook of Organic Chemistry

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions(each in 50 words)*	*1-12*	*3*	*30*
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C	*Answer any 4 out of 6 questions(each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS FOR THEORY

UNITS	SECTION A	SECTION B	SECTION C
I	3	2	2
II	3	1	1
III	2	1	1
IV	2	2	1
V	2	1	1
TOTAL	**12**	**7**	**6**

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	2	3	2	3
CO 2	3	2	3	2	3
CO 3	3	2	3	2	3
CO 4	3	2	3	2	3
CO 5	3	2	2	2	3
Ave.	3	2	2.8	2	3

PSO-CO-question paper mapping

CO No.	**COURSE OUTCOME**	**PSOs ADDRESSED**	**COGNITIVE LEVEL (K1 to K6)**
CO1	To understand the chemistry of transition and inner transition elements..	PSO 1, PSO 3, PSO 5.	K1, K2, K3, K4, K5.
CO2	To acquire knowledge about the metal present in the ore and its benign extraction procedures.	PSO 1, PSO 3, PSO 5.	K1, K2, K3, K4, K5.
CO3	To predict the IUPAC nomenclature and isomerism of coordination complexes	PSO 1, PSO 3, PSO 5.	K1, K2, K3, K4, K5.
CO4	To explain the magnetic property and color of the complexes by applying the theories related to coordination compounds.	PSO 1, PSO 3, PSO 5.	K1, K2, K3, K4, K5.
CO5	To gain knowledge of reaction mechanism in coordination compounds and biological importance of transition metals	PSO 1, PSO 5.	K1, K2, K3, K4, K5.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

PROGRAMME: B. Sc. CHEMISTRY	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** CORE- XVI
COURSE NAME: ANALYTICAL CHEMISTRY- II	**COURSE CODE:**
SEMESTER: VI	**MARKS:**100
CREDITS: 4	**TOTAL HOURS:** 60
THEORY	

COURSE OBJECTIVE:

To provide a knowledge on instrumental methods of analytical techniques and spectroscopy.

COURSE OUTCOMES:

1 Analyze the data obtained from the following analytical instruments – Polarography, X-ray, electron & neutron diffraction.
2 Interpret in detail about the spectroscopic data of AAS, UV-Visible and IR spectroscopy.
3 Determine the structure of organic compounds using Nuclear Magnetic Resonance spectroscopy.
4 Make use of various types of mass spectrometers, in the applications of structure determination of organic and inorganic molecules.
5 Apply the knowledge about various radio analytical techniques and computational techniques.

UNIT I: Polarography and Diffraction Methods (15 HOURS)

Polarography - principle, dropping mercury electrode, advantages and disadvantages, residual, migration and diffusion currents. Ilkovic equation andsignificance. Instrumentation - experimental assembly and electrodes. Current voltage curve, half-wave potential ($E_{1/2}$) and Id, - influence of temperature and agitation on diffusion layer. Applications -qualitative and quantitative applications for inorganic systems.

Theory, instrumentation and applications of X – ray analyses.

UNIT II: Molecular Spectroscopy (15 HOURS)

Ultraviolet and Visible spectroscopy: theory, instrumentation and application (qualitative and quantitative) – photometric titrations. Infrared Spectroscopy: Theory, instrumentation and applications. Raman Spectroscopy: Theory, instrumentation andapplication.

UNIT III: NMR Spectroscopy (10 HOURS)

Nuclear Magnetic Resonance Spectroscopy: Theory - Chemical Shift, Spin-spin Coupling,

Shielding and Deshielding, instrumentation and application to the structural determination of organic compounds (simple organic molecule- upto 10 carbons).

UNIT IV: Mass Spectrometry (10 HOURS)

Mass Spectrometry: Principle, instrumentation of mass spectrometer, various analyzers, principles of fragmentation - McLafferty rearrangement and Nitrogen rule and application to simple organic molecules for structure identification.

UNIT V: Atomic spectroscopy and Radio-Analytical Techniques (10 HOURS)

Principle, instrumentation and applications of Atomic Absorption Spectroscopy and Flame Photometry.

Radio-Analytical technique: Tracer technique, radiocarbon dating, activation analysis, radiometric analysis and titrations and isotopic dilution analysis.

PRESCRIBED BOOKS:

1. R Gopalan, K. Rengarajan, P.S. Subramanian, Elements of Analytical Chemistry,Sultan Chand & Sons, Third Edition , 2003.
2. David Harvey, Modern Analytical Chemistry, McGraw-Hill, First Edition, 2000.
3. R. C. Mendham, J. D. Denney, and Barnes M. Thomas, Vogel's Text Book of Quantitative Chemical Analysis, Pearson Education Pvt. Ltd., Sixth Edition, 2004.
4. K. V. Raman, Computers in Chemistry, Tata McGraw-Hill Education, First Edition,1993.

REFERENCE BOOKS:

1. Douglas A. Skoog, Donald M. West and F. James Holler, Fundamentals of Analytical Chemistry, Harcourt Asia Pvt. Ltd., Ninth Edition, 2001.
2. Douglas A. Skoog, Donald M. West and F. James Holler, Analytical Chemistry- An Introduction, Saunders College Publishers, Seventh Edition, 2000.
3. Dean, John A., Merritt, Lynne L., Settle, Frank A., Willard, Hobart H; Instrumental Methods of Analysis, Wadsworth Publishing Co Inc., Seventh Edition, 1988.
4. D. A. Skoog, Principles of Instrumental Analysis, Saunders College Publishing, Philadelphia, London, Fifth Edition, 1998.

E-LEARNING RESOURCES:

1. www.epgpathshala.nic.in
2. www.nptel.ac.in
3. http:/swayam.gov.in

GUIDELINES TO THE QUESTION PAPER SETTERS
QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions(each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions(each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions(each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS FOR THEORY

UNIT	SECTION A	SECTION B	SECTION C
I	3	2	2
II	3	1	1
III	2	1	1
IV	2	2	1
V	2	1	1
TOTAL	**12**	**7**	**6**

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	3	2
CO 2	3	3	3	3	2
CO 3	3	3	3	3	2
CO 4	3	3	3	3	2
CO 5	3	3	3	3	2
Ave.	3	3	3	3	2

PSO-CO-question paper mapping

CO No.	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	To analyze the data obtained from the following analytical instruments – Polarography, X-ray, electron & neutron diffraction.	PSO 1, PSO 2, PSO 3, PSO4.	K1, K2, K3, K4, K5.
CO2	To interpret in detail about the spectroscopic data of AAS, UV-Visible and IR spectroscopy.	PSO 1, PSO 2, PSO 3, PSO4.	K1, K2, K3, K4, K5.
CO3	To determine the structure of organic compounds using Nuclear Magnetic Resonance spectroscopy.	PSO 1, PSO 2, PSO 3, PSO4.	K1, K2, K3, K4, K5.
CO4	To make use of various types of mass spectrometers, in the applications of structure determination of organic and inorganic molecules.	PSO 1, PSO 2, PSO 3, PSO4.	K1, K2, K3, K4, K5.
CO5	To apply the knowledge about various radio analytical techniques and computational techniques .	PSO 1, PSO 2, PSO 3, PSO4.	K1, K2, K3, K4, K5.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

PROGRAMME: B. Sc. CHEMISTRY	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** ELECTIVE
COURSE NAME: NANOCHEMISTRY AND NANOTECHNOLOGY	**COURSE CODE:**
SEMESTER: VI	**MARKS:**100
CREDITS: 5	**TOTAL HOURS:** 60
THEORY	

COURSE OBJECTIVE:

To create general awareness on nanomaterials and applications.

COURSE OUTCOMES:

1 Understand the basic concepts of nanomaterials in the field of nanotechnology as well as the differences of nanomaterials with their bulk counterparts.
2 Acquire the knowledge on various synthesis methods of nanomaterials and their extraordinary properties like electrical, mechanical and optical.
3 Learn about different methodologies used in fabrication of nanomaterials and focuses on CNT nanocomposites and dendrimers.
4 Explore the knowledge about wide applications in various fields like electronics, medicine and industries.
5 Understand about the toxicity of nanomaterials in health, environmental and social issues.

UNIT I: Introduction to Nanotechnology (10 HOURS)

Definitions - Nano, nanoscience, and nano technology, nanograins, nanoclusters, nanoinclusions (Lycurgus cup etc). Nano in nature - difference between bulk and nanomaterials - challenges in nanotechnology - Allotropes of carbon, CNT - SWCNT and MWCNT.

UNIT II: Preparation and Properties of Nanomaterials – I (15 HOURS)

Influence of nucleation rate on the size of the crystals - macroscopic to microscopic crystals and nanocrystals - large surface to volume ratio, top-down and bottom-up approaches, self-assembly process - grain boundary volume in nanocrystals - defects in nanocrystals - surface effects on the properties. Size dependent properties - magnetic, electronic and optical.

UNIT III: Preparation and Properties of Nanomaterials – II (15 HOURS)

Synthesis of bulk nanostructured materials - Sol gel processing - mechanical alloying and milling - inert gas condensation technique - bulk and nano composite materials – grinding high energy ball milling - types of balls - WC and ZrO_2- materials – ball ratio – limitations melt quenching and annealing. - Metals (Au, Ag) - Metal oxides (TiO_2, ZnO) - Semiconductors (Si, CdS) – nanocomposites.

UNIT IV: Applications of Nanotechnology (10 HOURS)

Applications- electronics, sensors, catalysis, nanocomposites (NCMs) and environmental. Current medical practice -treatment methodology - principles of nanomedicine – nanomedical perspective and the medical applications – Nanomedicine:diagnosis, nanopharmaceuticals, biocompatible nanomedical materials. Industrial applications of nanomaterials: nanocoatings, nanotextiles deodorant/antiperspirant, shaving/depilatory products, foot powder, oral care.

UNIT V: Nanotoxicity (10 HOURS)

Ethical, safety and regulatory issues of nanomedicine. Nano toxicology: toxicity of carbon nanomaterials, handling of nanomaterials, health implication of nanomaterials, environmental toxicity. Green Nanochemistry.

PRESCRIBED BOOKS:

1. B.S. Murty, P. Shankar, Baldev Raj, B B Rath, James Murday; Textbook of Nanoscience and Nanotechnology, 2013.
2. T. Pradeep, A Textbook of Nanoscience and Nanotechnology, Springer publishing service, 2017.
3. P. I. Varghese, T. Pradeep, A Textbook of Nanoscience and Nanotechnology, Tata McGraw-Hill Education, 2003.
4. Dinesh C Agrawal, Introduction to Nanoscience and Nanomaterials, World Scientific Publisher, 2013.

REFERENCE BOOKS:

1. M. Wilson, K. Kannangara, G Smith, M. Simmons, B. Raguse, Nanotechnology: BasicScience and Emerging Technologies, Overseas Press India Pvt. Ltd., New Delhi, First Edition, 2005.
2. C. N. R. Rao, A. Muller, A. K. Cheetham , The Chemistry of Nanomaterials Synthesis, Properties and Applications, Wiley VCH Verlag Gmbh &Co., Weinheim, 2004.
3. Kenneth J. Klabunde , Nanoscale Materials Science, John Wiley & Sons, Inc., 2001.
4. C. S. S. R. Kumar, J. Hormes, C. Leuschner, Nanofabrication Towards Biomedical Applications, Wiley –VCH Verlag GmbH & Co, Weinheim, 2004.
5. W. Rainer, Nano Electronics and information Technology, Wiley, 2003.
6. G. Cao, Naostructures and Nanomaterials: Synthesis, Properties and Applications,Imperical College Press, 2004.
7. M. J. Jackson, Micro fabrication and Nanomanufacturing, CRC press. 2005.

8. G. Cao, Naostructures and Nanomaterials: Synthesis, Properties and Applications,Imperical College Press, 2004
9. W. T. S Huck, Nanoscale assembly: Chemical Techniques (Nanostructure Science and Technology, Springer, 2005.
10. Robert A. Freitas Jr., Nanomedicine, Volume IIA: Biocompatibility, Landes Bioscience, Georgetown, TX, 2003.
11. Parag Diwan and Ashish Bharadwaj, Nano Medicines, Pentagon Press, 2006.
12. Nancy A. Monteiro - Riviere and C. Lang Tran, Nanotoxicology, Characterization,Dosing and Health Effects, Informa Healthcare, 2007.
13. Kumar, Challa S. S. R., Nanomaterials - Toxicity, Health and Environmental Issues,Wiley - VCH, Weinheim, 2006.

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions(each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions(each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions(each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS FOR THEORY

UNIT	SECTION A	SECTION B	SECTION C
I	3	2	2
II	3	1	1
III	2	1	1
IV	2	2	1
V	2	1	1
TOTAL	**12**	**7**	**6**

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
Ave.	3	3	3	3	3

PSO-CO-question paper mapping

CO No.	**COURSE OUTCOME**	**PSOs ADDRESSED**	**COGNITIVE LEVEL (K1 to K6)**
CO1	To understand the basic concepts of nanomaterials in the field of nanotechnology as well as the differences of nanomaterials with their bulk counterparts.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4, K5.
CO2	To acquire the knowledge on various synthesis methods of nanomaterials and their extraordinary properties like electrical, mechanical and optical.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4, K5.
CO3	To learn about different methodologies used in fabrication of nanomaterials and focuses on CNT nanocomposites and dendrimers.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4, K5.
CO4	To explore the knowledge about wide applications in various fields like electronics, medicine and industries.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4, K5.
CO5	Understand about the toxicity of nanomaterials in health, environmental and social issues.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4, K5.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

PROGRAMME: B. Sc. CHEMISTRY	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** ELECTIVE
COURSE NAME: INDUSTRIAL CHEMISTRY	**COURSE CODE:**
SEMESTER: VI	**MARKS:**100
CREDITS: 5	**TOTAL HOURS:** 60
THEORY	

COURSE OBJECTIVE:

To have the thorough knowledge on various chemical industries and their manufacturing processes.

COURSE OUTCOMES:

1. Understand the needs of industrial requirements, types of fuels, waste management system, application of the industrial catalyst like palladium, platinum, titanium and Raney nickel.
2. Acquire knowledge about petrochemicals industry, crude oil, composition of crude oil synthetic petrol process for synthetic petrol.
3. Understand the preparation and properties of organic solvents like DMSO, DMF dioxane and THF.
4. Equip about manufacture of Cl_2, caustic soda and chlorates of Na and K, oils, synthetic detergents and shampoo.
5. Gain knowledge about the extraction and purification of metals.

UNIT I: Fuels and Catalysts (10 HOURS)

Fuels - types of fuels with examples - coal - carbonization of coal - coal tar distillation - liquid fuels - gaseous fuels - selection of fuels - energy - sources of energy - renewable and non - renewable energies - non-conventional energies. Industrial catalysts - Types of catalysts - Functions and applications of Raney Nickel, Pd, $CuCrO_4$, TiO_2, Al, V and Pt based catalysts and zeolites.

UNIT II: Petrochemical Industries (15 HOURS)

Crude oil - constitution and distillation - composition of different distillates - pour points, depressants, drag reducers, viscosity reducers, ignition point, flash point octane number - cracking - catalysts used in petroleum industries - structure, selectivity and applications. Manufacture of synthetic petrol - Bergius and Fischer Tropsh processes - Manufacture of petrochemicals and petrochemical polymers - Ethylene glycol, Glycerine, Chlorophrene, Butane diols, Xylenes.

UNIT III: Fertilizers and Speciality Chemicals (15 HOURS)

Manufacture - Properties and industrial uses of solvents - DMF, DMSO, THF and Diozane. Fertilizers - Raw materials, manufacture (flow chart chemical process withequations) of ammonium nitrate, ammonium sulphate, urea, calcium cyanamide, calciumammonium nitrate, sodium nitrate, ammonium chloride, ammonium phosphate, superphosphate of lime, NPK fertilizers, Manufacture in pure form of the following – Sodium carbonate, Oxalic acid, Potassium dichromate, Perchloric acid.

UNIT IV: Oils, Soaps and Detergents (10 HOURS)

Manufacture of Cl_2, NaOH and Chlorates of Na and K - manufacture of perchlorate. Oils - difference between oils and fats - manufacture of cotton seed oil and soybean oil - refining of oil - manufacture of soaps - toilet and transparent soaps - Detergents - synthetic detergents - surface active agents and their classification - manufacture of anionic, cationic and non ionic detergents and shampoo.

Sugar industry - manufacture of sugar from cane sugar and beet root. Manufacture of leather - hides - Vegetable and chrome tanning finishing. Manufacture of dinitrophenols, malathion, parathion, schradan and dementon.

UNIT V: Metallurgy and environment (10 HOURS)

General methods of metallurgy - ores - types - methods of concentration of ores - hydro metallurgy, phyrometallurgy - various reduction process, refining of metals - extractionof Cr, Mn, V, Co, Pt, U and Th. Environmental problems of chemicals industries - methods of control - sewage treatment and waste management. Requirements of an industry - location - water - industrial water treatment - safety measures - pilot plants.

PRESCRIBED BOOKS:

1. B.K. Sharma, Industrial Chemistry, Goel Publishing House, Meerut,2014
2. C. E.Drydense, Outlines of Chemical Technology, Gopala Rao, Eastwest Press, New Delhi, Third Edition, 1997.

REFERENCE BOOKS:

1. G.T. Austin, R.N. Shreve, Chemical Process Industries, Tata McGraw Hill publishing company, Mumbai, Fifth Edition, 2017.
2. H. Steines, Introduction to Petrochemicals, Pergaman Press, 1961.
3. Alan Cottrel, An Introduction to Metallurgy, Orient Longman, 2012.

E-LEARNING RESOURCES:

1. www.epgpathshala.nic.in
2. http:/swayam.gov.in

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions(each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions(each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions(each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS FOR THEORY

UNIT	SECTION A	SECTION B	SECTION C
I	3	2	2
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TOTAL	**12**	**7**	**6**

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2	3	2	3	2
CO 2	3	3	2	3	2
CO 3	2	2	2	2	2
CO 4	2	2	3	2	2
CO 5	2	3	3	2	3
Ave.	2.2	2.7	2.4	2.4	2.2

PSO-CO-question paper mapping

CO No.	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	To understand the needs of industrial requirements, types of fuels, waste management system, application of the industrial catalyst like palladium, platinum. titanium and Raney nickel.	PSO 2, PSO4, PSO 5.	K1, K2, K3, K4.
CO2	To acquire knowledge about petrochemicals industry, crude oil, composition of crude oil synthetic petrol process for synthetic petrol.	PSO 1, PSO 2, PSO4.	K1, K2, K3, K4.
CO3	To understand the preparation and properties of organic solvents like DMSO, DMF, dioxane and THF.	PSO 1, PSO 2.	K1, K2, K3, K4.
CO4	To equip about manufacture of Cl_2, caustic soda and chlorates of Na and K, oils, synthetic detergents and shampoo.	PSO 3.	K1, K2, K3, K4.
CO5	To gain knowledge about the extraction and purification of metals.	PSO 2, PSO 3, PSO 5.	K1, K2, K3, K4.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

PROGRAMME: B. Sc. CHEMISTRY	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** ELECTIVE
COURSE NAME: PHARMACEUTICAL CHEMISTRY	**COURSE CODE:**
SEMESTER: VI	**MARKS:**100
CREDITS: 5	**TOTAL HOURS:** 60
THEORY	

COURSE OBJECTIVE:

To understand the pharmacology, drugs and their mechanism of action, various diseases and to introduce the knowledge on pharmaceutical industries and their functioning.

COURSE OUTCOMES:

1 Gain knowledge about the common diseases and their cure, understand the pharmacodynamics and pharmacokinetics medicinal plant.

2 Understand the mechanism of drug action, absorption of drugs, assay and metabolism of drugs.

3 Acquire an idea about drugs used as anesthetics, analgesics, antibiotics, know about the treatment of AIDS and cancer.

4 Recognize common body ailments – diabetes and cholesterol – hypoglycemic drugs, cardiovascular drugs and psychedelic drugs.

5 Get awareness about the components and functioning pharmaceutical industries and various regulatory bodies.

UNIT I: Introduction (10 HOURS)

Common diseases – Infective diseases – insect - born, air - born and water born- hereditary diseases. Terminology of drugs, pharmacology, pharmacognosy, pharmacodynamics, pharmacokinetics, antimetabolites. Indian medicinal plants – Tulsi, Neem, Keezhanelli and their importance.

UNIT II: Pharmacology and Metabolism (15 HOURS)

Mechanism of drug action – Action at cellular and extra cellular sites. Absorption of drugs – routes of administration, factors affecting absorption – Assay of drugs – chemical, biological, immunological assays, LD_{50} and ED_{50}, therapeutic index, drug dosage. Metabolism of drugs through oxidation, reduction, hydrolysis and conjugate processes; factors affecting metabolism.

UNIT III: Drugs **(10 HOURS)**

Definition and two examples each: Anesthetics – General and local; Analgesics – Narcotic, non-narcotic and synthetic; Antipyretics and anti-inflammatory agents. Antibiotics: penicillin, streptomycin, chloramphenicol and tetracyclins – Antivirals, AIDS: symptoms, prevention, treatment – Cancer and neoplastic agents.

UNIT IV: Lifestyle diseases and hematology **(15 HOURS)**

Diabetes – Causes, hyper and hypoglycemic drugs – Blood pressure – Systolic and Diastolic, Hypertensive drugs – cardiovascular drugs – antiarrhythmic, antianginals, vasodilators – Psychedelic drugs, hypnotics, sedatives – Lipid profile – HDL, LDL cholesterol, lipid lowering drugs. Composition of Blood: Blood grouping and Matching – Role of blood as Oxygen carrier, Coagulation of Blood - Coagulants, Anticoagulants. Anaemia – Causes and control.

UNIT V: Pharmaceutical Industries: Functioning and Documentations **(10 HOURS)**

Introduction of pharma industry - research and development unit - process development and batch manufacturing - quality control and quality assurance – specifications Standard Operating Procedures (SOP) – Standard Testing Procedures (STP) – Material safety data sheets– journals – pharmacopeia – patents (product and process) – reports andrecords. Regulatory affairs for pharma industries like GLP, GMP, ISO, and FDA.

PRESCRIBED BOOKS:

1. Jayashree Ghosh, A Textbook of Pharmaceutical Chemistry, S. Chand and Company Ltd. 2012.
2. Ashutosh Kar, Medicinal Chemistry, New Age International Ltd., Seventh Edition 2018.
3. Divid A. William, Thomas Lemke, O. Foyes, Principles of Medicinal Chemistry, Lippincott Williams & Wilkins; 7th Edition, 2012.
4. Bertram G. Katzung, Basic & Clinical Pharmacology, McGraw-Hill Medical, Fifteenth Edition, 2018.

REFERENCE BOOKS:

1. Elizabeth Prichard, Victoria Barwick, Quality in the Analytical Chemistry Laboratory, John Wiley and sons, New York, 2007.
2. W Funk, V Dammann, G. Donnevert, Quality Assurance in Analytical, VCHW einheim, New York, 2006.

E-LEARNING RESOURCES

1. www.epgpathshala.nic.in
2. www.nptel.ac.in
3. http:/swayam.gov.in

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

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BREAK UP OF QUESTIONS FOR THEORY

UNIT	SECTION A	SECTION B	SECTION C
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PSO – CO mapping

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CO 3	2	3	3	3	2
CO 4	3	2	2	2	2
CO 5	2	3	2	3	2
Ave.	2.4	2.4	2.2	2.6	2.0

PSO-CO-question paper mapping

CO No.	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	To gain knowledge about the common diseases and their cure, understand the pharmacodynamics and pharmacokinetics medicinal plant.	PSO 1.	K1, K2, K3, K4, K5.
CO2	To understand the mechanism of drug action, absorption of drugs, assay and metabolism of drugs.	PSO4.	K1, K2, K3, K4, K5.
CO3	To acquire an idea about drugs used as anaestheics, analgesics, antibiotics, know about the treatment of AIDS and cancer.	PSO 2, PSO 3, PSO4.	K1, K2, K3, K4, K5.
CO4	To recognize common body ailments – diabetes and cholesterol – hypoglycemic drugs, cardiovascular drugs and psychedelic drugs.	PSO 1.	K1, K2, K3, K4, K5.
CO5	To get awareness about the components and functioning pharmaceutical industries and various regulatory bodies.	PSO 2, PSO4.	K1, K2, K3, K4, K5.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

PROGRAMME: B. Sc. CHEMISTRY	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** ELECTIVE
COURSE NAME: APPLIED ELECTROCHEMISTRY	**COURSE CODE:**
SEMESTER: VI	**MARKS:**100
CREDITS: 5	**TOTAL HOURS:** 60
THEORY	

COURSE OBJECTIVE:

To know the applications of electrochemistry in industrial processes viz., metallurgy, coating, cells and corrosion.

COURSE OUTCOMES:

1 Explain the electrochemical process in industry, electrochemical cell reactions and special feature of electro-organic synthesis.

2 Acquire the knowledge of electrodeposition of metals, electro refining, electro chemical purification, recovery of metals during hydro metallurgy

3 Understand the fundamental principles of electroplating, factors affecting electroplating, Hull cell experiments

4 Describe basic principle of chemical and electrical energies, batteries, fuel cells

5 Explain the stability of metals, emf series, factors affecting corrosion, prevention of corrosion, Pourbaix and Evan's diagram

UNIT I: Industrial Electrochemistry (10 HOURS)

Electrochemical process in industry - components of electrochemical reactions - Types of electrolytes - Cathodes and anodes in electrochemical reactor - separators. Inorganic electrochemical: Caustic soda and chlorine production, mercury cells, diaphragm cells, membrane cells - Advantage chlorates, perchlorates, hydrogen peroxide. Organic electrochemical: Special feature of electro-organic synthesis - electro chemical oxidation. Kolbe synthesis - electro reduction of carbonyl compounds - adiponitrile synthesis.

UNIT II: Electrometallurgy (15 HOURS)

Electro deposition of metals - principles - nucleation and growth of crystals - nature of electro deposits. Hydrometallurgy: Recovery of meals. Recovery of silver from photographic emulsion - electro refining - production of high copper; process description. Pyro-metallurgy: Necessity for using molten electrolytes - reactors for molten salt electrolytes - Production of aluminium - electrodes and electrode reactions in cryolite melt. Electrochemical purification of aluminium - other metals through molten salt electrolysis - Magnesium and sodium brief outline.

UNIT III: Electroplating (15 HOURS)

Fundamental principles - nature of deposits for electroplating - Hull cell experiments - operating conditions and nature of deposits - throwing power - preparation of samples for electroplating - chemical and electrochemical cleaning - electroplating of copper, nickel and cadmium. Electroless plating: Importance, plating of non-metals - both composition - electroless plating of copper and nickel.

UNIT IV: Electrochemical Power Sources (10 HOURS)

Basic principles, requirements for a good power source - Types of power sources. PrimaryBatteries: Description of primary cells - alkaline, manganese cells - silver oxide - zinc cells -lithium primary cells - applications. Secondary Batteries: applications - chargedischarge efficiency - cycle life - energy density - lead acid batteries, lithium ion batteries for electric vehicles.

Fuel Cells: Basic principles - Hydrogen, oxygen fuel cells - gas diffusion electrodes for fuel cells - alkaline fuel cells.

UNIT V: Corrosion and Prevention (10 HOURS)

Principles - stability of metals - EMF series - active and noble metals. pH effect of stability - Pourbaix diagram - Kinetics of corrosion - mixed potential process - cathodic reaction - anodic reaction - corrosion current - active dissolution - passivation - break down of passivity - Evans diagram. Method of corrosion protection. Principles and inhibition of anodic, cathodic processes – Inhibitors for corrosion protection - protective coatings- types of coatings - protection of structures and pipelines - cathodic protection - examples - sacrificial anodes - protection of ships in sea water.

PRESCRIBED BOOKS:

1. K.L. Kapoor, Physical chemistry, MacMillan India Ltd, Third Edition, 2009.
2. S. Glasstone, Introduction to Electrochemistry, Liton educational Publishing INC, Reprint 2010.

REFERENCE BOOKS:

1. D. Pletcher and F.C. Waish, Industrial Chemistry, Second Edition, 1990.
2. C.H. Hamann, A. Hamnett and W. Vielstich, Electrochemistry, Weinheim-Wiely VCH,1998.
3. D.B. Hibbert, Introduction to Electrochemistry, McMillan, London, 1993.

E-LEARNING RESOURCES:

1. www.epgpathshala.nic.in
2. www.nptel.ac.in
3. http:/swayam.gov.in

GUIDELINES TO THE QUESTION PAPER SETTERS
QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions(each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions(each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions(each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS FOR THEORY

UNIT	SECTION A	SECTION B	SECTION C
I	3	2	2
II	3	1	1
III	2	1	1
IV	2	2	1
V	2	1	1
TOTAL	**12**	**7**	**6**

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	2
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
Ave.	3	3	3	3	2.8

PSO-CO-question paper mapping

CO No.	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	To explain the electrochemical process in industry, electrochemical cell reactions and special feature of electro-organic synthesis.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO2	To acquire the knowledge of electrodeposition of metals, electro refining, electro chemical purification, recovery of metals during hydro metallurgy	PSO 1, PSO 2, PSO 3, PSO4.	K1, K2, K3, K4.
CO3	To understand the fundamental principles of electroplating, factors affecting electroplating, Hull cell experiments	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO4	To describe basic principle of chemical and electrical energies, batteries , fuel cells	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO5	To explain the stability of metals, emf series, factors affecting corrosion, prevention of corrosion, Pourbaix and Evan's diagram	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

PROGRAMME: B. Sc. CHEMISTRY	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** ELECTIVE
COURSE NAME: POLYMER CHEMISTRY	**COURSE CODE:**
SEMESTER: VI	**MARKS:**100
CREDITS: 5	**TOTAL HOURS:** 60
THEORY	

COURSE OBJECTIVE:

To develop the knowledge on chemistry of polymers and their applications.

COURSE OUTCOMES:

1 Know the chemistry behind the various polymers and their preparations.

2 Understand the properties of various polymers and their intended applications.

3 Have an idea on moulding of polymers to fabricate innovative shapes.

4 Know the methods and preparation of commercial polymers

5 Gain a knowledge on biopolymers and biomaterials.

UNIT I: Introduction to Polymers (15 HOURS)

Importance of polymers: Basic concept - Monomers and polymers - definition. Classification of polymers on the basis of microstrucutres, macrostructures and applications (thermosetting and thermoplastics). Distinction among plastics, elastomers and fibers. Homo and hetero polymers and copolymers.

Chemistry of polymerization: Chain polymerisation, free radical, ionic, coordination and step polymerisation. Polyaddition and polycondensation - miscellaneous ring - opening and group transfer polymerisations.

UNIT II: Physical Properties and Reactions of Polymers (15 HOURS)

Properties: Glass transition temperature (Tg) - Definition - Factors affecting Tg - relationships between Tg and molecular weight and melting point. Importance of Tg.Molecular weight of polymers: Number average, weight average, sedimentation and viscosity average molecular weights. Molecular weights and degree of polymerisation. Reactions: hydrolysis - hydrogenation - addition - substitutions - cross-linking, vulcanisation andcyclisation reactions. Polymer degradation: Basic idea of thermal, photo and oxidative degradations of polymers.

UNIT III: Polymerization Techniques and Processing (10 HOURS)

Polymerisation techniques: Bulk, solution, suspension, emulsion, melt condensation and interfacial polycondensation polymerisations. Polymer processing: Calendering - die casting, rotational casting - compression. Injection moulding.

UNIT IV: Chemistry of Commercial Polymers (10 HOURS)

General methods of preparation, properties and uses of the following: Teflon, polymethylmethacrylate. Polyethylene, polystyrene, PAN, polyesters, polycarbonates,polyamides (Kevlar), polyurethanes, PVC, epoxy resins, rubber styrene and neoprene rubbers, Phenol-formaldehydes and urea - formaldehyde resins.

UNIT V: Advances in Polymers (10 HOURS)

Biopolymers – biomaterials; polymers in medical field. High temperature and fire - resistant polymers – Silicones - carbon Fibers (Basic idea only). Biodegradable polymers, conducting polymers.

PRESCRIBED BOOKS:

1. F.W. Billmeyer, A Text book of Polymer Science, Jr. John Wiley & Sons, Second Edition, 2007.
2 .V.R. Gowariker, N.V. Viswanathan and Jayader Sreedhar, Polymer Science, New age International Pvt. Ltd., Fourth Edition, 2021.

REFERENCE BOOKS:

1. B.K. Sharma, Polymer Chemistry, Goel Publishing House, 2019.
2. M.S. Bhatnagar, A Text book of Polymer Chemistry, S Chand publishing, Reprint 2016.
3. M.G. Arora, and M.S. Yadav, Polymer Chemistry, Anmol Publications Private Ltd., NewDelhi, Second Revised Edition, 2003

E-LEARNING RESOURCES:

1. www.epgpathshala.nic.in
2. www.nptel.ac.in
3. http:/swayam.gov.in

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions(each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions(each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions(each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS FOR THEORY

UNIT	SECTION A	SECTION B	SECTION C
I	3	2	2
II	3	1	1
III	2	1	1
IV	2	2	1
V	2	1	1
TOTAL	**12**	**7**	**6**

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	2
CO 4	3	3	3	2	3
CO 5	3	3	3	3	3
Ave.	3	3	3	3	2.8

PSO-CO-question paper mapping

CO No.	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	To know the chemistry behind the various polymers and their preparations.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO2	To understand the properties of various polymers and their intended applications	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO3	To have an idea on moulding of polymers to fabricate innovative shapes.	PSO 1, PSO 2, PSO 3, PSO4.	K1, K2, K3, K4.
CO4	To know the methods and preparation of commercial polymers	PSO 1, PSO 2, PSO 3, PSO 5.	K1, K2, K3, K4.
CO5	To gain a knowledge on biopolymers and biomaterials.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

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ALLIED CHEMISTRY

For B.Sc., Physics, Mathematics,

Plant Biology & Plant Biotechnology,

Advanced Zoology & Biotechnology

and

Biotechnology

CHEMISTRY - I

(For Mathematics & Physics)

PROGRAMME: B. Sc. Mathematics & Physics	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** ALLIED
COURSE NAME: CHEMISTRY - I	**COURSE CODE:**
SEMESTER: I	**MARKS:**100
CREDITS: 3	**TOTAL HOURS:** 75
THEORY	

COURSE OBJECTIVE:

To understand the basics of atomic orbitals, chemical bonds, hybridization, concepts of thermodynamics and analytical techniques.

COURSE OUTCOMES:

1 Gain in-depth knowledge about the theories of chemical bonding, nuclear reactions and its applications.

2 Evaluate the efficiencies and uses of various fuels and fertilizers.

3 Explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.

4 Apply various thermodynamic principles to physical and chemical processes.

5 Explain various methods to identify an appropriate method for the separation of chemical components.

UNIT I: Chemical Bonding and Nuclear Chemistry (15 HOURS)

Chemical Bonding**:** Molecular Orbital Theory-bonding, antibonding and nonbonding orbitals. Molecular orbital diagrams for Hydrogen, Helium, Nitrogen and oxygen; bond order and magnetic properties.

Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers- Differences between chemical reactions and nuclear reactions - group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences – Stellar energy. Applications of radioisotopes - carbon dating, rock dating and medicinal applications.

UNIT II: Industrial Chemistry (15 HOURS)

Fuels: Fuel gases: Natural gas, water gas, semiwater gas, carbureted water gas, producer gas, CNG, LPG and oil gas (manufacturing details not required). Silicones**:** Synthesis, properties and uses of silicones.

Fertilizers: Urea, ammonium sulphate, potassium nitrate, NPK fertilizer, super phosphate, triple superphosphate.

UNIT III: Fundamental Concepts in Organic Chemistry (15 HOURS)

Hybridization: Orbital overlap, hybridization and geometry of CH_4, C_2H_4, C_2H_2 and C_6H_6. Electronic effects: Inductive effect and consequences on K_a and K_b of organic acids and bases, electromeric, mesomeric, hyperconjugation and steric- examples.

Reaction mechanisms: Types of reactions – aromaticity (Huckel's rule)- aromatic electrophilic substitution; nitration, halogenation, Friedel - Craft's alkylation and acylation. Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.

UNIT IV: Thermodynamics and Phase Equilibria (20 HOURS)

Thermodynamics: Types of systems, reversible and irreversible processes, isothermal and adiabatic processes and spontaneous processes. Statements of first law and second law of thermodynamics. Carnot's cycle and efficiency of heat engine. Entropy and its significance. Free energy change and its importance (no derivation). Conditions for spontaneity in terms ofentropy and Gibbs free energy. Relationship between Gibbs free energy and entropy.

Phase Equilibria**:** Phase rule - definition of terms in it. Applications of phase rule to water system. Two component system - Reduced phase rule and its application to a simple eutectic system (Pb-Ag).

UNIT V: Analytical Chemistry (10 HOURS)

(Lab safety rules – common laboratory hazards –MSDS; Fire extinguishers-types and uses – Chemical waste and safe disposal) *

Introduction to qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques – extraction, distillation and crystallization.

Chromatography: principle and application of column, paper and thin layerchromatography.

Self-Study: Not for End Semester Examinations.

PRESCRIBED BOOKS:

1. V. Veeraiyan, Text book of Ancillary Chemistry; Highmount publishing house,Chennai, First Edition, 2009.
2. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.

3. Arun Bahl, B. S. Bahl, Advanced Organic Chemistry; S. Chand and Company, NewDelhi, Twenty Third Edition, 2012.
4. P. L. Soni, H. M. Chawla, Text Book of Organic Chemistry; Sultan Chand & sons,New Delhi, Twenty Ninth Edition, 2007.

REFERENCE BOOKS:

1. P. L. Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, Twentieth Edition, 2007.
2. B. R. Puri, L. R. Sharma, M. S. Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, Forty Seventh edition, 2018.
3. B. K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, Sixteenth Eedition, 2014.

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions(each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions(each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions(each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS FOR THEORY

UNIT	SECTION A		SECTION B		SECTION C
	Theory	**Problem**	**Theory**	**Problem**	
I	3		1	1	2
II	2		1		1
III	2		1		1
IV	2	1	2		1
V	2		1		1
TOTAL	**12**		**7**		**6**

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	2	2
CO 2	3	3	3	2	2
CO 3	3	3	3	3	3
CO 4	3	3	3	2	3
CO 5	3	3	3	3	2
Ave.	3	3	3	2.4	2.4

PSO-CO-question paper mapping

CO No.	**COURSE OUTCOME**	**PSOs ADDRESSED**	**COGNITIVE LEVEL (K1 to K6)**
CO1	To gain in-depth knowledge about the theories of chemical bonding, nuclear reactions and its applications.	PSO 1, PSO 2, PSO 3.	K1, K2, K3, K4.
CO2	To evaluate the efficiencies and uses of various fuels and fertilizers.	PSO 1, PSO 2, PSO 3.	K1, K2, K3, K4.
CO3	To explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO4	To apply various thermodynamic principles to physical and chemical processes.	PSO 1, PSO 2, PSO 3, PSO 5.	K1, K2, K3, K4.
CO5	To explain various methods to identify an appropriate method for the separation of chemical components.	PSO 1, PSO 2, PSO 3, PSO4.	K1, K2, K3, K4.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

CHEMISTRY - II

(For Mathematics & Physics)

PROGRAMME: B. Sc. Mathematics & Physics	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** ALLIED
COURSE NAME: CHEMISTRY - II	**COURSE CODE:**
SEMESTER: II	**MARKS:**100
CREDITS: 3	**TOTAL HOURS:** 75
THEORY	

COURSE OBJECTIVE:

To acquire the knowledge about the nomenclature of coordination compounds and to understand the concepts of kinetics, catalysis, electrochemistry and photochemistry

COURSE OUTCOMES:

1 Write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology

2 Explain the preparation and property of carbohydrate, amino acids and nucleic acids.

3 Apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.

4 Identify the reaction rate, order for chemical reaction and explain the purpose of a catalyst.

5 Outline the various type of photochemical process.

UNIT I: Co-ordination Chemistry and Water Technology (15 HOURS)

Co-ordination Chemistry: Definition of terms - IUPAC Nomenclature - Werner's theory - EAN rule - Pauling's theory – Postulates - Applications to $[Ni(CO)_4]$, $[Ni(CN)_4]^{2-}$, $[Co(CN)_6]^{3-}$ Chelation - Biological role of Haemoglobin and Chlorophyll (elementary idea) - Applications in qualitative and quantitative analysis.

Water Technology: Hardness of water, determination of hardness of water usingEDTA method, zeolite method - Purification techniques - BOD, COD.

UNIT II: Carbohydrates and Amino acids (15 HOURS)

Carbohydrates: Classification, preparation and properties of glucose, fructose and sucrose. Discussion of open chain ring structures of glucose and fructose. Glucose –fructose interconversion. Properties of starch and cellulose.

Amino acids: Classification - preparation and properties of alanine, preparation ofdipeptides using Bergmann method. RNA and DNA (elementary idea only).

UNIT III: Electrochemistry **(15 HOURS)**

Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials - electrochemical series. Strong and weak electrolytes - ionic product of water - pH, pKa, pKb. Conductometric titrations - - buffer solutions and its biological applications - electroplating - Nickel and chrome plating - Types of cells - fuel cells - corrosion and its prevention.

UNIT IV: Kinetics and Catalysis **(15 HOURS)**

Order and molecularity. Integrated rate expression for I and II (2A → Products) order reactions. Pseudo first order reaction, methods of determining order of a reaction - Half life period – Catalysis - homogeneous and heterogeneous, catalyst used in Contact and Haber's processes. Concept of energy of activation and Arrhenius equation.

UNIT V: Photochemistry **(15 HOURS)**

Grothus-Drapper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield - Hydrogen-chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).

PRESCRIBED BOOKS:

1. V. Veeraiyan, Text book of Ancillary Chemistry; Highmount publishing house,Chennai, First Edition, 2009.
2. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.
3. Arun Bahl, B. S. Bahl, Advanced Organic Chemistry; S. Chand and Company, NewDelhi, Twenty Third Edition, 2012.
4. P. L. Soni, H. M. Chawla, Text Book of Organic Chemistry; Sultan Chand & sons,New Delhi, Twenty Ninth Edition, 2007.

REFERENCE BOOKS:

1. P. L. Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, TwentiethE, 2007.
2. R. Puri, L. R. Sharma, M. S. Pathania, Text book Physical Chemistry; VishalPublishing Co., New Delhi, Forty Seventh Edition, 2018.
3. B. K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, Sixteenth Edition, 2014.

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions(each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions(each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions(each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS FOR THEORY

UNIT	SECTION A		SECTION B		SECTION C
	Theory	**Problem**	**Theory**	**Problem**	
I	3		2		2
II	3		1		1
III	1	1	1		1
IV	2		1	1	1
V	2		1		1
TOTAL	**12**		**7**		**6**

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	2	3	2	3	2
CO 4	3	3	2	2	3
CO 5	3	3	2	2	2
Ave.	2.8	3	2.4	2.6	2.6

PSO-CO-question paper mapping

CO No.	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	To write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO2	To explain the preparation and property of carbohydrate, amino acids and nucleic acids.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO3	To apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.	PSO 2, PSO4.	K1, K2, K3, K4.
CO4	To identify the reaction rate, order for chemical reaction and explain the purpose of a catalyst.	PSO 1, PSO 2, PSO 5.	K1, K2, K3, K4.
CO5	To outline the various type of photochemical process.	PSO 1, PSO 2.	K1, K2, K3, K4.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

CHEMISTRY - I

(For PBPBT and AZBT)

PROGRAMME: B. Sc. PBPBT and AZBT	**BATCH**: 2024-27
PART: III	**COURSE COMPONENT:** ALLIED
COURSE NAME: CHEMISTRY - I	**COURSE CODE:**
SEMESTER: III	**MARKS:**100
CREDITS: 3	**TOTAL HOURS:** 75
THEORY	

COURSE OBJECTIVE:

To understand the basics of atomic orbitals, chemical bonds, hybridization and analytical techniques.

COURSE OUTCOMES:

1 State the theories of chemical bonding, nuclear reactions and its applications.

2 Evaluate the efficiencies and uses of various fuels and fertilizers.

3 Explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.

4 Demonstrate the structure and uses of antibiotics, anesthetics, antipyretics and artificial sugars.

5 Analyse various methods to identify an appropriate method for the separation of chemical components.

UNIT I: Chemical Bonding and Nuclear Chemistry (15 HOURS)

Chemical Bonding: Molecular Orbital Theory-bonding, antibonding and nonbonding orbitals. M. O diagrams for Hydrogen, Helium, Nitrogen and oxygen; bond order and magnetic properties.

Nuclear Chemistry: Fundamental particles - Isotopes, Isobars, Isotones and Isomers- Differences between chemical reactions and nuclear reactions - group displacement law. Nuclear binding energy - mass defect - calculations. Nuclear fission and nuclear fusion - differences – Stellar energy. Applications of radioisotopes - carbon dating, rock dating and medicinal applications.

UNIT II: Industrial Chemistry (15 HOURS)

Fuels: Fuel gases: Natural gas, water gas, semiwater gas, carbureted water gas,producer gas, CNG, LPG and oil gas (manufacturing details not required).

Silicones: Synthesis, properties and uses of silicones.

Fertilizers: Urea, ammonium sulphate, potassium nitrate NPK fertilizer, superphosphate, triple superphosphate.

UNIT III: Fundamental Concepts in Organic Chemistry (20 HOURS)

Hybridization: Orbital overlap hybridization and geometry of CH_4, C_2H_4, C_2H_2 and C_6H_6. Polar effects: Inductive effect and consequences on K_a and K_b of organic acids and bases, electromeric , mesomeric, hyperconjugation and steric- examples and explanation.

Reaction mechanisms: Types of reactions - aromaticity- aromatic electrophilicsubstitution; nitration, halogenation, Friedel - Craft's alkylation and acylation.

Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.

UNIT IV: Medicinal and essential organic compounds (15 HOURS)

Definition, structure and uses: Antibiotics viz., Penicillin, Chloramphenicol and Streptomycin; Anaesthetics viz., Chloroform and ether; Antipyretics viz., aspirin, paracetamol and ibuprofen; Artificial sugar viz., saccharin, Aspartame and cyclamate; Organic Halogen compounds viz., Freon, Teflon.

UNIT V: Analytical Chemistry (10 HOURS)

(Lab safety rules – common laboratory hazards –MSDS; Fire extinguishers-types and uses – Chemical waste and safe disposal.)*

Introduction qualitative and quantitative analysis. Principles of volumetric analysis. Separation and purification techniques: extraction, distillation and crystallization.
Chromatography: principle and application of column, paper and thin layer chromatography.

Self Study: Not for End Semester Examinations.

PRESCRIBED BOOKS:

1. V. Veeraiyan, Text book of Ancillary Chemistry; Highmount publishing house,Chennai, First Edition, 2009.
2. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.
3. Arun Bahl, B. S. Bahl, Advanced Organic Chemistry; S. Chand and Company, NewDelhi, Twenty Third Edition, 2012.
4. P. L. Soni, H. M. Chawla, Text Book of Inorganic Chemistry; Sultan Chand & sons,New Delhi, Twenty NinthEedition, 2007.

REFERENCE BOOKS:

1. P. L. Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, Twentieth Edition, 2007.
2. B. K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, Sixteenth Edition, 2014.
3. Jayashree gosh, Fundamental Concepts of Applied Chemistry; Sulan & Chand,Edition – 2006.

GUIDELINES TO THE QUESTION PAPER SETTERS
QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions(each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions(each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions(each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS FOR THEORY

UNIT	SECTION A		SECTION B		SECTION C
	Theory	**Problem**	**Theory**	**Problem**	
I	3		1	1	2
II	3		1		1
III	2		1		1
IV	2		2		1
V	2		1		1
TOTAL	**12**		**7**		**6**

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	2	3	2
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
Ave.	3	3	2.8	3	2.8

PSO-CO-question paper mapping

CO No.	**COURSE OUTCOME**	**PSOs ADDRESSED**	**COGNITIVE LEVEL (K1 to K6)**
CO1	To state the theories of chemical bonding, nuclear reactions and its applications.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO2	To evaluate the efficiencies and uses of various fuels and fertilizers.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO3	Explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.	PSO 1, PSO 2, PSO4.	K1, K2, K3, K4.
CO4	Demonstrate the structure and uses of antibiotics, anaesthetics, antipyretics and artificial sugars.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO5	Analyse various methods to identify an appropriate method for the separation of chemical components.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

CHEMISTRY - II

(For PBPBT and AZBT)

PROGRAMME: B. Sc. PBPBT and AZBT	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT**: ALLIED
COURSE NAME: CHEMISTRY - II	**COURSE CODE:**
SEMESTER: IV	**MARKS:**100
CREDITS: 3	**TOTAL HOURS:** 75
THEORY	

COURSE OBJECTIVE:

To acquire the knowledge about the nomenclature of coordination compounds, carbohydrates and to understand the concepts of kinetics, catalysis, electrochemistry and photochemistry

COURSE OUTCOMES:

1 Write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology.

2 Explain the preparation and property of carbohydrate.

3 Enlighten the biological role of transition metals, amino acids and nucleic acids.

4 Apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.

5 Outline the various type of photochemical process.

UNIT I: Co-ordination Chemistry and Water Technology (15 HOURS)

Co-ordination Chemistry**:** Definition of terms - IUPAC Nomenclature - Werner's theory - EAN rule - Pauling's theory – Postulates - Applications to $[Ni(CO)_4]$, $[Ni(CN)_4]^{2-}$, $[Co(CN)_6]^{3-}$ Chelation - Biological role of Haemoglobin and Chlorophyll (elementary idea) - Applications in qualitative and quantitative analysis.

Water Technology: Hardness of water, determination of hardness of water usingEDTA method, zeolite method - Purification techniques – BOD and COD.

UNIT II: Carbohydrates (15 HOURS)

Classification, preparation and properties of glucose and fructose. Discussion of open chain ring structures of glucose and fructose. Muta rotation, Glucose-fructose interconversion. Preparation and properties of sucrose, starch and cellulose.

UNIT III: Amino Acids and Essential elements of biosystem (15 HOURS)

Classification - preparation and properties of alanine, preparation of dipeptides using Bergmann method - Proteins-classification – structure - Colour reactions - Biological functions – nucleosides - nucleotides - RNA and DNA – structure. Essentials of trace metals in biological system- Na, Cu, K, Zn, Fe, Mg.

UNIT IV: Electrochemistry (15 HOURS)

Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials - electrochemical series. Strong and weak electrolytes - ionic product of water - pH, pKa, pKb. Conductometric titrations - buffer solutions and its biological applications - electroplating - Nickel and chrome plating - Types of cells - fuel cells - corrosion and its prevention.

UNIT V: Photochemistry (15 HOURS)

Grothus-Drapper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield - Hydrogen-chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).

TEXTBOOKS:

1. V. Veeraiyan, Text book of Ancillary Chemistry; Highmount publishing house,Chennai, First Edition, 2009.
2. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.
3. Arun Bahl, B. S. Bahl, Advanced Organic Chemistry; S. Chand and Company, NewDelhi, Twenty Third Edition, 2012.
4. P. L. Soni, H. M. Chawla, Text Book of Organic Chemistry; Sultan Chand & sons,New Delhi, Twenty Ninth Edition, 2007.

REFERENCES:

1. Arun Bahl, B. S. Bahl, Advanced Organic Chemistry; S. Chand and Company, New Delhi, Twenty third Edition, 2012.
2. P. L. Soni, H. M. Chawla, Text Book of Organic Chemistry; Sultan Chand & sons,New Delhi, Twenty ninth Edition, 2007.
3. P. L. Soni, Mohan Katyal, Text book of Inorganic chemistry; Sultan Chand and Company, New Delhi, Twentieth Edition, 2007.
4. B. R. Puri, L. R. Sharma, M. S. Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, Forty seventh Edition, 2018.

5. B. K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, Sixteenth Edition, 2014.

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions(each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions(each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions(each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS FOR THEORY

UNIT	SECTION A		SECTION B		SECTION C
	Theory	**Problem**			
I	3		2		2
II	3		1		1
III	2		1		1
IV	1	1	2		1
V	2		1		1
TOTAL	**12**		**7**		**6**

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	3	3
CO 2	3	2	3	2	3
CO 3	3	3	3	3	3
CO 4	3	3	3	2	3
CO 5	3	3	3	2	2
Ave.	3	2.8	3	2.4	2.8

PSO-CO-question paper mapping

CO No.	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	To write the IUPAC name for complex, different theories to explain the bonding in coordination compounds and water technology.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO2	To explain the preparation and property of carbohydrates.	PSO 1, PSO 3, PSO 5.	K1, K2, K3, K4.
CO3	To enlighten the biological role of transition metals, amino acids and nucleic acids.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO4	To apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.	PSO 1, PSO 2, PSO 3, PSO 5.	K1, K2, K3, K4.
CO5	To outline the various type of photochemical process.	PSO 1, PSO 2, PSO 3.	K1, K2, K3, K4.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

Chemistry

(For Biotechnology)

PROGRAMME: B. Sc. Biotechnology	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** ALLIED
COURSE NAME: CHEMISTRY	**COURSE CODE:**
SEMESTER: I	**MARKS:**100
CREDITS: 4	**TOTAL HOURS:** 75
THEORY	

COURSE OBJECTIVE:

To understand the fundamentals of chemical bonds, hybridization and organic functional groups, thermodynamics, kinetics and catalysis, electrochemistry and photochemistry.

COURSE OUTCOMES:

1 Explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.

2 Apply various thermodynamic principles, systems and phase rule.

3 Apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.

4 Identify the reaction rate, order for chemical reaction and explain the purpose of a catalyst.

5 Outline the various type of photochemical process.

UNIT I: Fundamental Concepts in Organic Chemistry (20 HOURS)

Hybridization: Orbital overlap, hybridization and geometry of CH_4, C_2H_4, C_2H_2 and C_6H_6. Electronic effects: Inductive effect and consequences on Ka and Kb of organic acids and bases, electromeric , mesomeric, hyperconjugation and steric- examples and

Reaction mechanisms: Types of reactions – aromaticity (Huckle's rule)- aromatic electrophilic substitution; nitration, halogenation, Friedel - Craft's alkylation and acylation.

Heterocyclic compounds: Preparation, properties of pyrrole and pyridine.

Stereochemistry: Classification- Optical isomerism: Optical activity, specific rotation, enantiomers, diastereomers, d, l and D, L notations of optical isomers – Cahn Ingold Prelog rules – R and S nomenclature (molecules with one chiral carbon), optical isomerism of lactic and tartaric acid. Geometrical isomerism – cis and trans, syn-anti and E-Z nomenclature. Geometrical isomerism in maleic, fumaric acids.

UNIT II: Thermodynamics (15 HOURS)

Types of systems, reversible and irreversible processes, isothermal and adiabatic processes and spontaneous processes. Statements of first law and second law of thermodynamics. Carnot's cycle and efficiency of heat engine. Entropy and its significance. Free energy change and its importance (no derivation). Conditions for spontaneity in terms of entropy and Gibbs free energy. Relationship between Gibbs free energy and entropy.

UNIT III: Electrochemistry (15 HOURS)

Galvanic cells - Standard hydrogen electrode - calomel electrode - standard electrode potentials - electrochemical series. Strong and weak electrolytes - ionic product of water - pH, pKa, pKb. Conductometric titrations - buffer solutions and its biological applications - electroplating - Nickel and chrome plating - Types of cells - fuel cells - corrosion and its prevention.

UNIT IV: Kinetics and Catalysis (15 HOURS)

Order and molecularity. Integrated rate expression for I and II ($2A \rightarrow$ Products) order reactions. Pseudo first order reaction, methods of determining order of a reaction - Half life period – Catalysis - homogeneous and heterogeneous, catalyst used in Contact and Haber's processes. Concept of energy of activation and Arrhenius equation.

UNIT V: Photochemistry (10 HOURS)

Grotthus-Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield - Hydrogen-chloride reaction. Phosphorescence, fluorescence, chemiluminescence and photosensitization and photosynthesis (definition with examples).

PRESCRIBED BOOKS:

1. V. Veeraiyan, Text book of Ancillary Chemistry; Highmount publishing house,Chennai, First Edition, 2009.
2. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.
3. Arun Bahl, B. S. Bahl, Advanced Organic Chemistry; S. Chand and Company, New Delhi, Twenty third Edition, 2012.
4. P. L. Soni, H. M. Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, Twenty ninth Edition, 2007.

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2. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.
3. Arun Bahl, B. S. Bahl, Advanced Organic Chemistry; S. Chand and Company, New Delhi, Twenty third Edition, 2012.
4. P. L. Soni, H. M. Chawla, Text Book of Organic Chemistry; Sultan Chand & sons, New Delhi, Twenty ninth Edition, 2007.
5. R. Puri, L. R. Sharma, M. S. Pathania, Text book Physical Chemistry; Vishal Publishing Co., New Delhi, Forty seventh Edition, 2018.

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions(each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions(each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions(each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS FOR THEORY

UNIT	SECTION A	SECTION B	SECTION C
I	3	2	2
II	3	1	1
III	2	1	1
IV	2	2	1
V	2	1	1
TOTAL	**12**	**7**	**6**

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	3	3
CO 2	3	2	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	2	3
CO 5	3	3	3	2	2
Ave.	3	2.8	3	2.6	2.8

PSO-CO-question paper mapping

CO No.	**COURSE OUTCOME**	**PSOs ADDRESSED**	**COGNITIVE LEVEL (K1 to K6)**
CO1	To explain the type of hybridization, electronic effect and mechanism involved in the organic reactions.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO2	To apply various thermodynamic principles, systems and phase rule.	PSO 1, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO3	To apply/demonstrate the electrochemistry principles in corrosion, electroplating and fuel cells.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO4	To identify the reaction rate, order for chemical reaction and explain the purpose of a catalyst.	PSO 1, PSO 2, PSO 3, PSO 5.	K1, K2, K3, K4.
CO5	To outline the various type of photochemical process.	PSO 1, PSO 2, PSO 3.	K1, K2, K3, K4.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

CHEMISTRY PRACTICAL

(Common for Mathematics, Physics, PBPB and AZBT students)

PROGRAMME: B. Sc. Mathematics, Physics, PBPB and AZBT	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** ALLIED
COURSE NAME: CHEMISTRY PRACTICAL	**COURSE CODE:**
SEMESTER: ODD & EVEN	**MARKS:**100
CREDITS: 4	**TOTAL HOURS:** 45
PRACTICAL	

COURSE OBJECTIVE:

To learn about the principles of volumetric analysis, preparation of solutions and handling of laboratory instruments.

COURSE OUTCOMES:

1 Gain an understanding of the use of standard flask and volumetric pipettes, burette.

2 Design and carry out the volumetric analysis such as acidimetry, alkalimetry and redox titrations.

3 Calculate and interpret the results of volumetric analysis

4 Identify the special elements (N, S & halogen) and nature of organic compounds

5 Detect the type of functional group present in the organic compounds.

1. VOLUMETRIC ANALYSIS

1. Estimation of sodium hydroxide using standard sodium carbonate.
2. Estimation of hydrochloric acid using standard oxalic acid.
3. Estimation of ferrous sulphate using standard Mohr's salt.
4. Estimation of oxalic acid using standard ferrous sulphate.
5. Estimation of potassium permanganate using standard sodium hydroxide.
6. Estimation of magnesium using EDTA.
7. Estimation of ferrous ion using diphenylamine as an indicator.

2. SYSTEMATIC ANALYSIS OF ORGANIC COMPOUNDS

The analysis must be carried out as follows:

(a) Functional group tests [phenol, acids (mono & di) aromatic primary amine, amides(mono & di), aldehyde and glucose].

(b) Detection of elements (N, S, Halogens)

(c) Distinguish between aliphatic and aromatic

(d) Saturated and unsaturated compounds.

REFERENCE BOOK:

1. V. Venkateswaran, R. Veerasamy, A. R. Kulandaivelu, Basic Principles of Practical Chemistry; Sultan Chand & sons, Second Edition, 1997.

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
Ave.	3	3	3	3	3

CHEMISTRY PRACTICAL
(For Biotechnology)

PROGRAMME: B. Sc. Biotechnology	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** ALLIED
COURSE NAME: CHEMISTRY PRACTICAL	**COURSE CODE:**
SEMESTER: I	**MARKS:**100
CREDITS: 3	**TOTAL HOURS:** 30
PRACTICAL	

COURSE OBJECTIVE:

To learn about the principles of volumetric analysis, preparation of solutions and handling of laboratory instruments.

COURSE OUTCOME

On completion of the course the students will be able

1 Describe the concept of normality, molarity, molality, equivalent weight and its related calculations.
2 Prepare primary and secondary solutions of volumetric analysis
3 Design and carry out the volumetric analysis such as acidimetry, alkalimetry and redox titrations.
4 Identify an appropriate indicator for the volumetric analysis
5 Calculate and interpret the results of volumetric analysis

Unit I: Preparation of Standard Solutions

1. Preparations of solutions based on normality
2. Preparations of solutions based on molarity
3. Preparations of solutions based on percentage
4. Preparation of Buffer solutions with determined pH

Unit II: Volumetric Analysis

1. Estimation of Sodium hydroxide using standard Sodium Carbonate.
2. Estimation of Hydrochloric acid using standard Oxalic acid.
3. Estimation of Ferrous sulphate using standard Mohr's salt
4. Estimation oxalic acid using standard Ferrous Sulphate.

Unit III: Demonstration Experiment:

1. Estimation of hardness of water using EDTA
2. Systematic analysis of simple organic molecules.

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
Ave.	3	3	3	3	3

Inter Disciplinary Elective-1

(***For other department students***)

PROGRAMME: UG	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** ELECTIVE
COURSE NAME: CHEMISTRY IN EVERYDAY LIFE	**COURSE CODE:**
SEMESTER: V	**MARKS:**100
CREDITS: 5	**TOTAL HOURS:** 75
THEORY	

COURSE OBJECTIVE:

To learn chemistry involved in our day to day life.

COURSE OUTCOMES:

1 Acquire knowledge about various methods of processing of milk, components and milk products.

2 Identify adulterated food, food additives and food colours used in food.

3 Outline the causes, symptoms and drugs used for various diseases.

4 Explain the production of vegetable oils, soaps, removal of hardness and role of fertilizers in plant growth.

5 Acquire knowledge about various polymers, resin Identification coding system and biodegradable polymers.

Unit I: Dairy chemistry **(15 HOURS)**

1.1 Milk Definition, general composition - physico - chemical changes taking place in milkdue to boiling, pasteurization, sterilization and homogenisation - explanation.

1.2 Components of milk - lipids, proteins, carbohydrates, vitamins, ash and mineral matters - names and functions.

1.3 Definition and compositions of cream, butter, ghee, icecrearn, stabiliser, emulsifier and emulsifier.

Unit II: Food Chemistry **(15 HOURS)**

2.1 Sources of food, types, Food adulteration- Common adulterants, Detection of adulterated foods by simple analytical techniques.

2.2 Food additives - artificial sweetners - Saccharin - Cyclomate and Aspartate.Food flavours - esters, aldehydes and heterocyclic compounds. Food colours – Emulsifying agents – preservatives - leavening agents. Baking powder - yeast - taste makers - MSG vinegar, Beverages-soft drinks-soda-fruit juices-alcoholic beverages, examples.

Unit III: Pharmaceutical chemistry (15 HOURS)

3.1 Definition of the following terms - drug, bacteria, virus and vaccine. Causes, symptomsand drugs for anaemia, jaundice, cholera, malaria, filarial, AIDS, Diabetes, Blood pressure, Cancer.

3.2. Indian medicinal plants and uses - tulasi, neem, kizhanelli, mango, semparuthi, adadodaiand thoothuvalai.

3.3 Definition and examples for the following – Analgesics, Antipyretics, Anaesthetics, Antibacterials, Antiseptics and Disinfectants (Structures not required)

Unit IV: Industrial Chemistry (15 HOURS)

4.1 Fats and oils - Sources of oils - production of refined vegetable oils - preservation.

4.2 Soaps and Detergents – toilet and transparent soaps-synthetic detergents-surface activeagents and their classification.

4.3 Fertilisers- Types and Importance of fertilizers-. Examples for insecticides, fungicides, pesticides and herbicides - ill effects of use of chemical fertilisers and insecticides.

4.4 Water – sources of water – Hard and soft water-methods of removal of hardness of water. (equations not needed)

Unit V: Polymer Chemistry (15 HOURS)

5.1 Classification and special properties of polymers - natural and synthetic - rubber, cellulose, starch, wool, silk - synthetic rubber, polyalkenes, acrylics, polyamides, polyesters, PVC polyurethane - starting materials and uses only. (structures not required for examination)

5.2 International Resin Identification Coding System and its significance in use - recycling. Bio-degradable polymers. Polymer waste management.

PRESCRIBED BOOKS:

1. Jayashree Ghosh, A Textbook of Pharmaceutical Chemistry, S. Chand and Company Ltd. 2012.
2. Ashutosh Kar, Medicinal Chemistry, New Age International Ltd., Seventh Edition 2018.
3. V.R. Gowariker, N.V. Viswanathan and Jayader Sreedhar, Polymer Science, New age international private limited, Fourth Edition, 2021.
4. K. Bagavathi Sundari, Applied Chemistry, MJP Publishers, First Edition, 2006.

REFERENCE BOOKS:

1. P.F.Fox and P.L.H. Mcsweeney, Dairy Chemistry and Biochemistry,Springer, Second Edition, 2016.
2. J. M. DeMan and J. W. Finley. Principles of Food Chemistry, Springer, Fourth Edition 2018.
3. B.K. Sharma, Polymer Chemistry, Goel Publishing House, 2019.
4. M.S. Bhatnagar, A Text book of Polymer Chemistry, S Chand publishing, Reprint, 2016.
5. Indian Medicinal Plants. Khare C.P. New Delhi, India: Springer,2007.
6. M. K. Jain, S. C. Sharma, Modern Organic Chemistry, Vishal Publishing, Fourth Reprint,2009.
7. P.L. Soni and Mohan katyal, Textbook of Inorganic Chemistry, Sultan Chand & Sons, Twentieth Edition, 2017.

E-LEARNING RESOURCES:

1. www.epgpathshala.nic.in
2. www.nptel.ac.in
3. http:/swayam.gov.in
4. https://technotes.alconox.com/detergents/types-of-surfactants
5. https://www.cantol.com/resources/types-of-insecticides

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions(each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions(each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions(each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS FOR THEORY

UNIT	SECTION A	SECTION B	SECTION C
I	3	2	2
II	3	1	1
III	2	1	1
IV	2	2	1
V	2	1	1
TOTAL	**12**	**7**	**6**

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	3	3
CO 4	3	3	3	3	3
CO 5	3	3	3	3	3
Ave.	3	3	3	3	3

PSO-CO-question paper mapping

CO No.	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	To acquire knowledge about various methods of processing of milk, components and milk products.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO2	To identify adulterated food, food additives and food colors used in food.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO3	To outline the causes, symptoms and drugs used for various diseases.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO4	To explain the production of vegetable oils, soaps, removal of hardness and role of fertilizers in plant growth.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO5	To acquire knowledge about various polymers, resin, identification coding system and biodegradable polymers.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

Inter Disciplinary Elective-2

(***For other department students***)

PROGRAMME: UG	**BATCH:** 2024-27
PART: III	**COURSE COMPONENT:** ELECTIVE
COURSE NAME: ESSENTIALS OF CHEMISTRY	**COURSE CODE:**
SEMESTER: V	**MARKS:**100
CREDITS: 5	**TOTAL HOURS:** 75
THEORY	

COURSE OBJECTIVE:

To gain knowledge about the importance of Chemistry around us.

COURSE OUTCOMES:

1 Identify adulterated food, food additives and food colours used in food.
2 Outline the functions and deficiency diseases of vitamins and minerals
3 Explain the causes and treatment of common diseases.
4 Demonstrate the methods of removal of hardness of water and role of fertilizers in plants growth.
5 Identify the forgery in documents, forged signatures, fake currency notes and different types of poisons.

Unit I: Food science (15 HOURS)

1.1 Food and Nutrition - Sources of food, types; Carbohydrates, Proteins, Fats, - Balanced diet - Food adulteration and detection of adulterated foods by simple analytical techniques.

1.2 Food additives - artificial sweeteners - Saccharin - Cyclomate and Aspartate. Food flavours - esters, aldehydes and heterocyclic compounds.

1.3 Food colours – Emulsifying agents – preservatives - leavening agents. Baking powder - yeast - taste makers - MSG vinegar Beverages-soft drinks-soda-fruit juices-alcoholic beverages, examples.

Unit II: Vitamins and minerals (15 HOURS)

2.1 Water soluble vitamins: Thiamine, riboflavin, niacin, pyridoxine, folic acid, cyanocobalamin and ascorbic acid and fat-soluble vitamins: A, D, E and K (structure not required)- role - deficiency diseases and food sources.

2.2 Functions, deficiency diseases and requirements of macro minerals - Sodium, potassium, calcium, phosphorus, magnesium and trace minerals - iron, iodine, zinc, copper and fluoride.

Unit III: Pharmaceutical chemistry (15 HOURS)

3.1 Definition and examples for the following – Analgesics, Antipyretics, Anaesthetics, Antibacterial, Antiseptics and Disinfectants (Structures not required).

3.2 Causes and treatment of common diseases - Dengue, Typhoid, Malaria, Tuberculosis, Jaundice and COVID 19.

3.3 Indian medicinal plants and uses - tulasi, neem, kizhanelli, mango, semparuthi, adadodai and thoothuvalai.

Unit IV: Industrial chemistry (15 HOURS)

4.1 Water Technology- Sources of water, soft and hard water, methods of removal of hardness, Purification techniques - zeolite method, reverse osmosis and ion exchange.

4.2 Soaps and Detergents – toilet and transparent soaps-synthetic detergents surface active agents and their classification.

4.3 Fertilizers: Definition, requirement of a fertilizer, Classification of fertilizers; Urea, ammonium sulphate, NPK fertilizer, super phosphate, triple superphosphate (uses only). Definition, examples of pesticides, fungicides, herbicides.

Unit V: Forensic chemistry (15 HOURS)

5.1 Forgery in documents, different types of forged signatures - simulated and traced forgeries, Detection of forgery - uses of ultraviolet rays, comparison of type written letters, checking silver line water mark in currency notes.

5.2 Definition of poisons, types of poisons - Detection of poisons - carbon monoxide, cyanide, ethanol and formaldehyde.

5.3 Classification of explosives – low explosives and high explosives. Common explosives - TNT, and RDX.

PRESCRIBED BOOKS:

1. Food chemistry, H. K. Chopra, P. S. Panesar, Narosa publishing house, 2010.
2. A textbook of pharmaceutical chemistry by Jayashree Ghosh, S Chand publishing, 2012.
3. S. Vaithyanathan, Text book of Ancillary Chemistry; Priya Publications, Karur, 2006.
4. B. K, Sharma, Industrial Chemistry; GOEL publishing house, Meerut, sixteenth edition, 2014.
5. Introduction to forensic chemistry, Kelly M. Elkins, CRC Press Taylor & Francis Group, 2019.

REFERENCE BOOKS:

1. Ashutosh Kar, Medicinal Chemistry, New Age International Ltd., Seventh Edition 2018.
2. Jay Siegel, Forensic chemistry: Fundamentals and applications, Wiley-Blackwell, First Edition, 2015.

GUIDELINES TO THE QUESTION PAPER SETTERS

QUESTION PAPER PATTERN

SECTION	QUESTION COMPONENT	NUMBERS	MARKS	TOTAL
A	*Answer any 10 out of 12 questions(each in 50 words)*	*1-12*	*3*	*30*
B	*Answer any 5 out of 7 questions(each in 300 words)*	*13-19*	*6*	*30*
C	*Answer any 4 out of 6 questions(each in 1200 words)*	*20-25*	*10*	*40*
TOTAL MARKS				**100**

BREAK UP OF QUESTIONS FOR THEORY

UNIT	SECTION A	SECTION B	SECTION C
I	3	2	2
II	3	1	1
III	2	1	1
IV	2	2	1
V	2	1	1
TOTAL	**12**	**7**	**6**

PSO – CO mapping

	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	3	3	3	3	3
CO 2	3	3	3	3	3
CO 3	3	3	3	2	3
CO 4	3	3	3	3	3
CO 5	3	3	2	2	3
Ave.	3	3	2.8	2.6	3

PSO-CO-question paper mapping

CO No.	COURSE OUTCOME	PSOs ADDRESSED	COGNITIVE LEVEL (K1 to K6)
CO1	To identify adulterated food, food additives and food colours used in food.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO2	To outline the functions and deficiency diseases of vitamins and minerals	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO3	To explain the causes and treatment of common diseases.	PSO 1, PSO 2, PSO 3, PSO 5.	K1, K2, K3, K4.
CO4	To demonstrate the methods of removal of hardness of water and role of fertilizers in plants growth.	PSO 1, PSO 2, PSO 3, PSO4, PSO 5.	K1, K2, K3, K4.
CO5	To identify the forgery in documents, forged signatures, fake currency notes and different types of poisons.	PSO 1, PSO 2, PSO 5.	K1, K2, K3, K4.

K1= Remember, K2= Understand, K3= Apply, K4=Analyse, K5= Evaluate, K6= Create

CERTIFICATE COURSE

ENTREPRENEUR SKILLS IN CHEMISTRY

COURSE OBJECTIVE:

To develop entrepreneur skills and to give hands on training to the preparation ofthe products for the start of small-scale industries.

UNIT - I: Food Chemistry

- Food adulteration - contamination of food items with clay stones, water and toxic chemicals - Common adulterants.
- Food additives, Natural and synthetic anti-oxidants, glazing agents (hazardous effect), food colourants, Preservatives, leavening agents, Baking powder and baking soda, yeast, MSG, vinegar.

UNIT – II: Dairy Chemistry

- Milk - General Composition of milk, constituents of milk- carbohydrates, lipids, proteins, vitamins and minerals. Processing of milk - Pasteurization, Homogenization.
- Special milk - standardized milk, homogenized milk, flavoured milk, toned milk, vitaminized milk, condensed milk-definition, composition and nutritive value.

UNIT- III: Hands on Experience

- Detection of adulterants in food items like coffee, tea, pepper, chilli powder, turmeric powder, butter, ghee, milk, honey etc., by simple techniques.
- Preparation of Jam, squash and Jelly, Gulkand, cottage cheese.
- Preparation of products like candles, soap, detergents, cleaning powder, shampoos, pain balm, tooth paste/powder and disinfectants in small scale.
- Extraction of oils from spices and flowers.
- Testing of water samples using testing kit.

MOOC [Optional]

Students can opt for Massive Open Online Courses during odd semesters.Two credits will be given for each course.

Students can choose a maximum of two courses.

SELF STUDY COURSES

INDIAN HERITAGE AND KNOWLEDGE SYSTEM

PROGRAMME: For all UG	**BATCH:** 2024-27
PART: IV	**COURSE COMPONENT:** Self Study Course
COURSE NAME: INDIAN HERITAGE AND KNOWLEDGE SYSTEM	**COURSE CODE:**
SEMESTER: III	**MARKS:**100
CREDITS: 2	
QUESTION PATTERN: MCQ	
THEORY	

Course Objective:

To delve into Indian Heritage, this course focuses on South Indian cultures and ancient knowledge like Yoga, Ayurveda, and Siddha, shaping the Nation's identity.

Course Outcomes:

1. Develop a comprehensive understanding among students of Indian heritage, its richness and diversity, and its role in shaping the nation's cultural identity.
2. Gain an enhanced insight into the artistic, architectural, and literary achievements of South India and other regions, fostering a sense of pride in Indian cultural heritage.
3. Enhance students' cultural literacy by gaining insights into traditional practices preserved through folklore across India.
4. Acquire knowledge among students of ancient Indian sciences for holistic well-being, promoting physical, mental, and spiritual health.
5. Develop a deeper understanding of the interconnectedness of spiritual, medicinal, and artistic dimensions within Indian Heritage systems.

UNIT I: Introduction to Indian Heritage

- **Concept of Heritage:** Definition, the importance of studying heritage, and its diverse forms.
- **Cultural Landscape of India:** Overview of major cultural zones in India, with a focus on South India.

  Key Concepts: Cultural heritage, diversity, tangible heritage (e.g., monuments), intangible heritage (e.g., traditions, practices).

UNIT II: Cultural Tapestry of South India

- **Literature:** The classical Tamil literature of *Sangam poetry*, the epic Kannada works like the *"Kuvempu Ramayana,"* the Telugu compositions of *Annamacharya,* and the poetic Malayalam works of Kerala's rich literary tradition.
- **Painting:** The intricate gold leaf work of *Tanjore* painting, the intricate patterns of *Mysore* painting, hand-painting or block-printing of Kalamkari.
- **Theatre:** The ancient art form of *Koothu* and the elaborate dance-dramas of *Bhagavata Mela* in Tamil Nadu, and the colourful folk theatre of *Yakshagana* in Karnataka.

- **UNESCO Indian Heritage Sites:** *Great Living Chola Temples* artistry, *Hampi*-Virupaksha Temple and the Vijaya Vittala Temple, *Mahabalipuram*- a treasure trove of Pallava art, *Mysore Palace*-Indo-Saracenic architecture, *Periyar National Park*- Western Ghats, *Kanchipuram*-City of Thousand Temples

UNIT III: Tamil Nadu Folklores

- **Origins and Significance:** Historical background of Tamil Nadu folklore and its cultural significance.
- **Folk Dances:** Exploration of traditional Tamil folk dances like *Karakattam, Kolattam,* and *Kummi.*
- **Folk Music:** Overview of folk music traditions in Tamil Nadu, including *Parai Attam and Villu Paatu.*
- **Rituals and Festivals:** Understanding the role of folklore in Tamil Nadu's rituals and festivals-*Pongal and Jallikattu.*

Key Concepts: Karakattam, Kolattam, Parai Attam, Villu Paatu, Tamil folk tales, cultural rituals.

UNIT IV: Unveiling the Knowledge Systems

- **Cultural Landscape of India:** Overview of major cultural zones in India, with a focus on South India.
- **Yoga:** Exploring the various aspects of Yoga - its philosophy, Eight Limbs, practices (e.g., Asanas, Pranayama), and benefits for physical and mental well-being.
- **Ayurveda:** Understanding the core principles of Ayurveda - its focus on holistic health, diagnosis, and treatment methods.

Key Concepts: Yoga philosophy, Asanas, Pranayama, Tridosha theory (Ayurveda), Doshas (Vata, Pitta, Kapha), Panchakarma, herbal medicine, Ayurvedic lifestyle.

UNIT V: Siddha Tradition and Other Knowledge Systems

- **Siddha Tradition:** Origins, philosophy, medicinal practices, and spiritual aspects.
- **Other Important Knowledge Systems:** Jyotish Shastra (Indian astrology), Natya Shastra (Treatise on performing arts).

Key Concepts: Siddha literature, alchemy, and spirituality in Siddha tradition. Pancha Boothas (Siddha), herbal remedies, Planetary influences, elements of classical Indian dance and music, and aesthetics in Natya Shastra.

CONTEMPORARY WORLD AND SUSTAINABLE DEVELOPMENT

PROGRAMME: For all UG	**BATCH:** 2024-27
PART: IV	**COURSE COMPONENT:** Self Study Course
COURSE NAME: CONTEMPORARY WORLD AND SUSTAINABLE DEVELOPMENT	**COURSE CODE:**
SEMESTER: III	**MARKS:**100
CREDITS: 2	
QUESTION PATTERN: MCQ	
THEORY	

Course Objective:

To delve into global dynamics, this course highlights Asia and India's pivotal role in achieving global sustainability objectives.

Course Outcomes:

1. Gain a comprehensive understanding of the key actors, institutions, and dynamics shaping the contemporary world order.
2. Acquire the ability to analyze the political, economic, and security challenges within major Asian regions, fostering informed perspectives on these critical issues.
3. Study the recent wars to develop critical thinking skills to assess the root causes, human costs, and potential solutions to contemporary conflicts.
4. Gain a deeper understanding of the principles and challenges of sustainable development, empowering them to advocate for responsible solutions at local, national, and international levels.
5. Equip to critically evaluate India's contributions to the SDGs, particularly through specific programs implemented in Tamil Nadu, and assess their effectiveness in achieving sustainable development goals.

UNIT I: Global Governance and Institutions

- **State & Non-State Actors:** Definition, types (nation-states, failed states), functions.
  Key Actors: International states, Intergovernmental organizations (IGOs), nongovernmental organizations (NGOs), multinational corporations (MNCs).
- **United Nations (UN):** Structure, key organs (General Assembly, Security Council), functions, WB, & others.
  Key Concepts: United Nations General Assembly, United Nations Security Council.
- **Regional Organizations:** European Union (EU), African Union (AU), North Atlantic Treaty Organization (NATO)
  Key Concepts: European Union Commission, African Union Commission, North Atlantic Treaty Organization.
- **International Law and Treaties:** Significance, role in addressing global challenges.
  Key Concepts: International Court of Justice, International Criminal Court, Geneva Conventions.

UNIT II: Contemporary Asia

Major Geographical Regions

- **Middle East:** Characterized by rich oil reserves, Complex political dynamics, and ongoing conflicts.
  Key countries: Iran, Iraq, Israel, Saudi Arabia, Syria, Turkey
- **Southeast Asia:** Rapid economic growth, Challenges- maritime security and environmental degradation.
  Key countries: Indonesia, Malaysia, Philippines, Singapore, Thailand, Vietnam
- **Far East:** Major economic powerhouses and Potential flashpoints.
  Key countries: China, Japan, North Korea, South Korea
- **Rise of China:** Political-South China Sea, Territorial disputes and Competition for Resources. Economic- China's Belt and Road Initiative (BRI)
- **Major Economic Centers: Singapore-** Global financial hub, **Hong Kong-** Special Administrative Region of China, **United Arab Emirates (UAE) -** Diversified economy driven by oil and gas, tourism, and trade.

Regional Organizations:

- Association of Southeast Asian Nations (ASEAN)
- South Asian Association for Regional Cooperation (SAARC)
- Bay of Bengal Initiative for Multi-Sectoral Technical and Economic Cooperation (BIMSTEC)
- Asia-Pacific Economic Cooperation (APEC)
- Shanghai Cooperation Organization (SCO)

UNIT III: Recent Wars of the World

- **Syrian Civil War (2011-present):** Bashar al-Assad regime, Syrian opposition groups, ISIS.
  Key Concepts: Origins of the conflict, humanitarian crisis, foreign intervention, refugee crisis.
- **Yemeni Civil War (2015-present):** Houthi rebels, Yemeni government, Saudi-led coalition.
  Key Concepts: Proxy war dynamics, humanitarian crisis, role of Iran and Saudi Arabia, UN peace efforts.
- **Ukraine Conflict (2014-present)**: Ukrainian government, Russian-backed separatists, Russia.
  Key Concepts: Annexation of Crimea, Donbas region conflict, Minsk agreements, NATO-Russia tensions.
- **Ethiopia Civil War (2020-present):** Ethiopian government, Tigray People's Liberation Front (TPLF), Eritrean forces.
  Key Concepts: Tigray conflict, humanitarian crisis, regional implications, efforts for ceasefire and peace talks.
- **Nagorno-Karabakh War (2020):** Armenia, Azerbaijan, Russia.
  Key Concepts: Conflict over Nagorno-Karabakh region, ceasefire agreement, role of Turkey, peace negotiations.
- **Myanmar Civil War (2021-present):** Myanmar military (Tatmadaw), ethnic armed groups, and Civilian resistance.
  Key Concepts: Coup aftermath, Rohingya crisis, ethnic conflicts, ASEAN mediation efforts.

UNIT IV: Sustainable Development Goals

- **Definition of Sustainable Development:** Balancing economic, social, and environmental needs.
  Key Concepts: United Nations Development Programme (UNDP), World Wildlife Fund (WWF), Sustainable Development Solutions Network (SDSN).
- **UN Sustainable Development Goals (SDGs):** Overview, targets.
  Key Concepts: United Nations, national governments, NGOs, private sector.
- **Challenges and Opportunities:** Achieving sustainability, global cooperation.
  Key Concepts: United Nations, national governments, civil society organizations, multinational corporations.

UNIT V: India's Role in Achieving Sustainable Development Goals (SDGs) with Tamil Nadu Initiatives

Addressing Basic Needs:

- **Goal 1: No Poverty**
  - National Rural Employment Guarantee Act (NREGA)
  - Kalaignar Kanchi Thalaiyalar Scheme
  - Ungal Thozhil Udhayanam (UTOY)
- **Goal 2: Zero Hunger**
  - National Food Security Act (NFSA)
  - Nutritious Noon Meal Programme
  - Annadhanam Scheme
  - Amma Unavagam
- **Goal 3: Good Health and Well-being**
  - National Health Mission (NHM)
  - Health Insurance of Tamil Nadu
  - Chief Minister's Comprehensive Health Insurance Scheme
  - Maruthuva Mitri
  - Amma Mini Clinics

Ensuring Essential Services:

- **Goal 4: Quality Education**
  - Sarva Shiksha Abhiyan (SSA)
  - Rashtriya Madhyamik Shiksha Abhiyan (RMSA)
  - Namakkal District Library Scheme
  - Pudhumai Penn Scheme under Higher Education Assurance Scheme (HEAS)
  - Free Coaching for Competitive Exams
- **Goal 6: Clean Water and Sanitation**
  - Swachh Bharat Mission (Clean India Mission)
  - National Rural Drinking Water Programme (NRDWP)
  - Jal Jeevan Mission Tamil Nadu
  - Namakku Naamey Scheme
  - Kudimaramathu Scheme
- **Goal 7: Affordable and Clean Energy**
  - National Solar Mission
  - Tamil Nadu Solar Energy Policy
  - Green House Scheme

Building Sustainable Communities:

- **Goal 11: Sustainable Cities and Communities**
  - Smart Cities Mission
  - Atal Mission for Rejuvenation and Urban Transformation (AMRUT)
  - Adi Dravidar Housing Scheme
- **Goal 13: Climate Action**
  - National Action Plan on Climate Change (NAPCC)
  - International Solar Alliance
  - Tamil Nadu Wind Energy Policy 2019
- **Goal 17: Partnerships for the Goals**
  - Development Assistance Programmes (DAPs)
  - International Development Cooperation (IDC)