

SRICT Institute of Science & Research
B.Sc. Sem. V
Teaching/Exam Scheme
w.e.f.:

Sr. No.	Course code	Category of course	Course title	Hours Per week			Tot. Con. hrs.	Credits	E	M	I	V	Total Marks
				L	T	P							
1	BC2301	Foundation Compulsory	Teaching Language through Literature- II	2	-	-	2	2	70	30			100
2	BC2302	Core Course	Chemistry-IX	4	-	-	4	4	70	30			100
3	BC2303	Core Course	Chemistry-X	4	-	-	4	4	70	30			100
4	BC2304	Core Course	Chemistry-XI	4	-	-	4	4	70	30			100
5	BC2305	Core Course	Chemistry-XII	4	-	-	4	4	70	30			100
6	BC2306	Core Course	Chemistry Practical – III	-	-	4	4	2			30	70	100
7	BC2307	Generic Elective	Petrochemicals	2	-	-	2	2	70	30			100
8	BC2308	Compulsory Elective	Summer Internship	-	-	-	*	1	50	-	-	-	50
			Total	20	0	4	24	23	470	180	30	70	750

Generic Elective	1. Petrochemicals 2. Sustainable Chemistry
Compulsory Elective	Summer Internship

Note:* Summer Internship have 35 hours per semester

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6	<p>Cloze Test: (Intermediate Level with Multiple Choices) N.B.: The passage for Cloze Test should be of about 200 words aiming at testing the students’ intermediate level of proficiency. It will contain six blanks each carrying one mark. Three options for each blank must be given below the passage. This is based on Basic English Grammar</p>	03
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Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	15	10	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom’s Taxonomy)

Reference Books:

1. (Text) India – A Journey through Stories (Oxford University Press)
2. David Green: Contemporary English Grammar Structure and Usage
3. M L Tickoo and Subramanian: Intermediate Grammar, Usage and Composition
4. Wren and Martin – High School English Grammar and Composition

Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Use English in day-to-day communication	20%
CO-2	Use various forms of vocabulary in varied situations in oral and written communication.	20%
CO-3	Comprehend the dynamics of various rules of grammar and check its validation while they speak and write language correctly	20%
CO-4	Use grammar effectively to make themselves competent Listener, Speaker, Reader and Writer by exposing to various set of situations	10%
CO-5	Write various formal and informal documents of day to day life	20%
CO-6	Prepare for lifelong learning and enjoyment of English Language and literature.	10%

List of Open Source Software/learning website:

- <http://www.english-online.org.uk/>
- <http://www.learnenglish.de/>

SRICT Institute of Science & Research
BACHELOR OF SCIENCE
Course Code: BC2302
Course Name: Chemistry-IX (INORGANIC CHEMISTRY)
Semester V
Type of course: Core Course
Prerequisite: Should have basic knowledge about inorganic chemistry.

Rationale: At the end of the course, students will have knowledge about acid and base concepts, boranes, coordination compound bonding, and metal carbonyls.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
			ESE (E)	PA (M)	ESE (V)	PA (I)		
4	0	0	4	70	30	-	-	100

Content:

Sr. No.	CONTENT	Total Hrs.
SECTION-A		
1	CONCEPTS OF ACIDS AND BASES Concept of acids and bases - Arrhenius concept - Bronsted-Lowry concept – The Lux-Flood concept - Lewis concept - Effect of solvents on relative strengths of acids and bases -Effect of substituents on relative strengths of acids and bases - Hard and soft acids and bases (HSAB) – Pearson concept - HSAB principle and its applications.	08
2	HYDRIDES OF BORANES Boron hydride and its classification, Wades Rule, preparation, properties, structure and bonding in diborane, tetra borane (10), penta borane (9), penta borane (11), hexaborane (10) and dodeca borane (12) anion.	08
3	THERMODYNAMIC AND KINETIC ASPECTS OF METAL COMPLEXES A brief out line of thermodynamic stability of metal complexes and factors affecting stability of metal complexes. Lability and inertness. Factors affecting lability of metal complexes. Labile and inert complexes on the basis of reaction rate, VBT and CFT.	08
SECTION-B		
4	BONDING IN TRANSITION METAL COMPLEXES Jahn Teller Theorem, Distortion in octahedral complexes. Ligand Field Theory. Molecular energy level diagram and magnetic properties for $[\text{CoF}_6]^{3-}$, $[\text{Co}(\text{NH}_3)_6]^{3+}$, $[\text{FeF}_6]^{3-}$, $[\text{Fe}(\text{CN})_6]^{3-}$, π - bonding in octahedral complexes.	08

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5	METAL CARBONYLS Definition, classification, nature of bonding in metal carbonyls, structure and IR spectra in Ni(CO) ₄ ;Fe(CO) ₅ , Fe ₂ (CO) ₉ , Mn ₂ (CO) ₁₀ , Cr(CO) ₆ , Co ₂ (CO) ₈ .	08
6	CORROSION AND ITS PROTECTION Definition and importance of corrosion, Types of corrosion: uniform, pitting, inter crystalline and stress cracking corrosion, electro-chemical theory of corrosion. Protection methods: Coating, Inhibitors (Organic, Inorganic, anodic, cathodic), anodic and cathodic protection.	08

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	15	10	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

- 1) Principles of Inorganic Chemistry by Puri, Sharma and Kalia
- 2) Inorganic Chemistry- Principles of structure and reactivity by J.E. Huhhey and E.A. Keiter.
- 3) Theoretical Inorganic chemistry by Day & Selbin, Affiliated East West Publ. Pvt. Ltd.
- 4) Advanced Inorganic Chemistry by Cotton and Wilkinson, John Wiley.
- Uni. Chemistry by B. H. Mohan
- 5) Structural Inorganic chemistry by A. F. Wells.
- 6) Chemical Bonding - an introduction By Rawal, Patel & Patel.
- 7) Environmental Chemistry by Amritha anand and Sugumar.
- 8) Basic Inorganic Chemistry by Cotton and Wilkinson
- 9) A Text book of Inorganic Chemistry by P.L.Soni
- 10) Introduction to Inorganic Chemistry by Durrant and Durrant
- 11) Modern Co-ordination Chemistry by R. Lewis and R.G. Wilkinson.
- 12) Quantum mechanics in chemistry by M. H. Hanna
- 13) Application of Group Theory to Chemistry by P.K.Bhattacharya., Himalaya PublishingHouse, Mumbai.
- 14) Quantum Rasayan, University Granth Nirman Board (Gujarat).
- 15) Environmental Chemistry by A.K. De.
- 16) The corrosion and oxidation of metals by Evans U.R. (1961), Arnold, London.
- 17) Corrosion, Causes and Prevention, Speller. F.,Mc Grw Hill,New york.
- 18) Dhatvik Ksharan, Part-I & II by M.N. Desai, Uni. Granth Nirman Board (Gujarat).
- 19) Corrosion and Corrosion Control, Uhlig H., Wiley.
- 20) Corrosion Engineering by Fontana M.G. and Green N.D., Mc Graw

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Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Explain concepts of acid and bases.	20%
CO-2	Relate various hydrides of boranes.	20%
CO-3	Discover stability of metal complexes.	20%
CO-4	Determine magnetic properties of various metal complexes.	10%
CO-5	Discuss structure and IR spectra of metal carbonyls.	20%
CO-6	Analyze corrosion and its protections.	10%

List of Open Source Software/learning website:

- <https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/>
- https://blog.feedspot.com/chemistry_websites/

SRICT Institute of Science & Research
BACHELOR OF SCIENCE
Course Code: BC2303
Course Name: Chemistry-X (ORGANIC CHEMISTRY)
Semester V
Type of course: Core Course

Prerequisite: Should have basic knowledge about reaction mechanism and spectroscopy.

Rationale: At the end of the course, students will have knowledge about organic reaction mechanism, aromaticity, and natural products.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	0	4	70	30	-	-	100

Content:

Sr. No.	CONTENT	Total Hrs.
SECTION-A		
1	REACTION MECHANISM (a) Different types of mechanism for Esterification and Hydrolysis: B_{AC}^2 , A_{AC}^2 , A_{AC}^1 , A_{AL}^1 (b) Mechanism of formation and hydrolysis of amides. (c) Pyrolytic elimination: Cope and Chugaev reaction. (d) Organic Name Reaction: Knoevenagel Reaction, Reformatsky Reaction, Claisen Condensation Reaction.	08
2	AROMATICITY Introduction to Aromaticity, Huckel's Rule, Aromatic Character of Arenes, Definition & Examples of Aromatic, Non-Aromatic, Anti-Aromatic Compounds (Benzenoids and Non-Benzenoids).	08
3	INFRARED SPECTROSCOPY Introduction, Range of infrared, characteristics of IR absorption frequencies: Origin of IR spectra, Fundamental Vibrations and Overtones, Number of fundamental vibration, IR active and forbidden vibrations, Coupled vibrations, Functional group region, and Finger print region. - Functional group detection.	08

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SECTION-B		
4	(A) ALKALOIDS Alkaloids: Definition, Classification, occurrence and extraction, General properties. Isolation, Properties and structural elucidation of Nicotine. (B) VITAMINS, STEROIDS AND HORMONES Vitamins - classification, sources, functions and deficiencies of fat-The B vitamin complex- Structural elucidation of Thiamin (B ₁) Steroids-introduction and classification: Cholesterol, Ergosterol Hormones -introduction and classification: Adrenalene.	08
5	AMINO ACIDS AND PROTEINS Amino acids: Introduction of Amino acid, Isoelectric Point, Nomenclature of Amino acids, Preparation, Physical and Chemical Properties of Amino acids. Proteins: Introduction, Structure, Classification, and Properties of Proteins.	08
6	NMR SPECTROSCOPY Nuclear magnetic resonance, instrumentation, proton NMR, nuclear shielding and deshielding, chemical shift, spin-spin splitting, interpretation of NMR spectra of simple organic molecules.	08

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	15	10	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

- 1) Organic Chemistry by Bahl and Bahl.
- 2) Reaction mechanism in organic chemistry by Mukhargy & Singh
- 3) Principles of reaction mechanism in organic chemistry by Dharmaraha & Chawla
- 4) Organic reaction mechanism by Bansal Tata Mac. Hill
- 5) Organic Chemistry (Vol I & II) 6 th Edn, I. L. Finar.
- 6) Organic Chemistry by Hendrickson, Cram & Hammond
- 7) Organic Chemistry by Brown R. F.
- 8) Organic Chemistry by Solomon W. Graham
- 9) Principles of Organic Synthesis- R. O. C. Norman
- 10) Basic Principles of Organic chemistry, by R. Y. Caserio, W. A. Benjamin
- 11) May's Chemistry of synthetic Drugs by Dyson.
- 12) Chemistry of drugs, Ener and Caldwell
- 13) Synthetic drugs by Tyagi and Yadav.

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- 14) Synthetic Organic Chemistry by O. P. Agarwal
 - 15) Organic Chemistry by Morrison and Boyd.
 - 16) Chemistry of organic Natural Product Vol. I & II by O. P. Agarwal.
 - 17) Chemistry of synthetic drugs by Trivedi
 - 18) Principles of Medicinal Chemistry Vol. I & II by S. S. Kadam, K. R. Mahadik, K. G. Bothara (Nirali Prakashan)
 - 19) Medicinal Chemistry By Asuthosh kar 4/e
 - 20) Organic reactions & their mechanism by P. S. Kalsi, New age international publishers
 - 21) Organic Name Reactions by Gautam Brahmachari, Narosa Publishing House, New Delhi.
 - 22) Organic Chemistry, 8th edition by Paula Yurkanis Bruice, University of California, Santa Barbara.

Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Identify and explain various reaction mechanism	20%
CO-2	Compare benzenoids and non benzenoids compounds	10%
CO-3	Interpret functional group region and fingerprint region.	20%
CO-4	Classify and elucidate natural products	20%
CO-5	Relate various amino acids and proteins.	10%
CO-6	Understand the basic concept of NMR spectroscopy.	20%

List of Open Source Software/learning website:

- <https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/>
- https://blog.feedspot.com/chemistry_websites/

SRICT Institute of Science & Research
BACHELOR OF SCIENCE
Course Code: BC2304
Course Name: Chemistry-XI (PHYSICAL CHEMISTRY)
Semester V
Type of course: Core Course

Prerequisite: Should have basic knowledge about reactions and law involved in physical chemistry.

Rationale: At the end of the course, students will have knowledge about thermodynamics, basics of chemical equilibrium, and nuclear chemistry.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	0	4	70	30	-	-	100

Content:

Sr. No.	CONTENT	Total Hrs.
SECTION-A		
1	THERMODYNAMICS-III Partial molal free energy, (chemical potential), Derivation of Gibb's Duhem Equation- The Nernst Heat Theorem (NHT), limitations of NHT, Statement of The third law of Thermodynamics, Consequence of third law of thermodynamics, Determination of absolute entropy of gases and liquids and solid, Applications of third law of thermodynamics- Numerical problems.	08
2	PHASE EQUILIBRIA-I Statement and meaning of the terms phase, component, degree of freedom, phase rule, phase equilibria, of one component system-water, CO ₂ , Sulphur system.	08
3	ELECROCHEMISTRY-III Concept of Oxidation and Reduction, Electrochemical series (Reduction series), definition of electrode, half-cell and cell, single electrode potential, sign of electrode potential, standard electrode potential (oxidation and reduction potential), Electrochemical process, Galvanic cell with example of Daniel cell, EMF of a cell and its measurements, Standard Weston cell, Different types of reversible electrodes, Determination of single electrode potential, Calculation of standard EMF of cell and Determination of cell reaction, Standard Hydrogen Electrode, Calomel electrode and Ag –AgCl electrode. Numerical problems.	08

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SECTION-B		
4	CHEMICAL EQUILIBRIUM Chemical equilibrium, Law of mass action, Thermodynamic derivation of the law of chemical equilibrium, Vant Hoff isotherm, Relations between K_p , K_c and K_x , Temperature dependence of the equilibrium constant: The van't Hoff Equation. Le-Chatelier-Braun principle. Numerical problems.	08
5	NUCLEAR CHEMISTRY-I Stable and unstable isotopes, separation of isotopes by different methods, gaseous diffusion, thermal diffusion, distillation, chemical exchange methods, Bainbridge velocity focusing mass spectrograph, Dempster's direction focusing mass spectrograph.	08
6	NUCLEAR CHEMISTRY-II Particle accelerators : Linear accelerator, Cyclotron, Discovery of artificial disintegration, Classification of nuclear reaction based on overall energy transformations and - particles used as projectiles, Merits and demerits of different projectiles - Application of radio isotopes as tracers in medicines, studying reaction mechanism in photosynthesis and age determination by Carbon- Dating method. Numerical problems.	08

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	15	10	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

REFERENCE BOOKS:

- Essential of Physical chemistry by Bahl and Bahl
- Principles of Physical Chemistry by Puri, Sharma and Pathania.
- Elements of physical chemistry by Glasstone and Lewis
- Physical chemistry by W. Moore
- Physical chemistry by Atkins
- Physical chemistry by G.K.Vemulapalli
- Physical chemistry by B.K.Sharma
- Physical chemistry by Gurdeep raj
- Physical chemistry by Negi and Anand
- Physical chemistry by K.L. Kapoor Vol 1-5.
- Physical chemistry by Baliga, Dhavale and Zaveri Vol 1-3.
- Physical chemistry by Dr. S. Pahari
- Nuclear chemistry by Arnikaar
- Electro chemistry by S. Glasstone
- Electrochemistry by B.K.Sharma

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16. Modern Electrochemistry by J'omBockris and Redd

17. Physical Chemistry by D.N. Bajpai.

Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Evaluate laws of thermodynamics	20%
CO-2	State phase equilibria	20%
CO-3	Examine different types of electrochemical cells and electrodes	20%
CO-4	Derive various laws of chemical equilibrium	10%
CO-5	Describe basic concepts of nuclear chemistry.	20%
CO-6	Classification and applications of nuclear chemistry.	10%

List of Open Source Software/learning website:

- <https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/>
- https://blog.feedspot.com/chemistry_websites/

SRICT Institute of Science & Research
BACHELOR OF SCIENCE
Course Code: BC2305
Course Name: Chemistry-XII (ANALYTICAL CHEMISTRY)
Semester V
Type of course: Core Course
Prerequisite: Should have basic knowledge about analytical titrations.

Rationale: At the end of the course, students will have knowledge about good laboratory practice, and titration techniques.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	0	4	70	30	-	-	100

Content:

Sr. No.	Content	Total Hrs.
SECTION-A		
1	INTRODUCTION TO ANALYTICAL CHEMISTRY Chemical and Instrumental Analysis (advantages and disadvantages) Overview of methods used in Quantitative analysis (classification of classical and instrumental analysis), Idea of significant figures-its importance. Accuracy- Method of expressing accuracy error analysis- types of errors-minimizing errors. Precision- methods of precision – mean, median, mean deviation, standard deviation.	08
2	GOOD LABORATORY PRACTICE Good lab practices, lab safety, waste disposal and managements, method of storing chemicals, solvents and glassware-Handling of chemicals [Carcinogenic chemical, Toxic and poisonous chemicals], List of Hazardous chemicals-General procedure for avoiding accidents [Apron, Safety goggles, Gloves pipetting process]-First aid technique [Burns, Eye accident, Cuts, Poisons, Gas poisoning, electric shock].	08
3	ACID BASE TITRATION Classification of electroanalytical methods, basic principle of pH metric and conductometric titrations. Different terms for titrant, titrand, analyte, end point and equivalence point. Theory of acid base indicators. Indicator range. Selection of proper indicators Calculation of pH at different stages of titrations of monobasic and dibasic acid with strong base Construction of titration curve, Titration of carbonate mixture and amino acids . Problems.	08

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SECTION-B		
4	<p>REDOX TITRATIONS Formal Potential, Redox reaction: $\text{FeSO}_4\text{-KMnO}_4$, $\text{Fe}^{+2}\text{-Ce}^{+4}$, Principle of redox indicators, Structural chemistry of indicators (Diphenyl amine, Ferroin), Construction of titration curves for titration of Fe^{2+} with Ce^{4+}. Calculation of equilibrium constants for redox system, Types of indicators, Theory of true Redox indicators (Numerical). Oxidants - KMnO_4, $\text{K}_2\text{Cr}_2\text{O}_7$. Reductants - Sodium thiosulphate, Sodium arsenite.</p>	08
5	<p>COMPLEXOMETRIC TITRATIONS EDTA titration, Absolute and conditional stability constant, Distribution of various species of EDTA as function of pH. Absolute and conditional stability constants. Derivation of factors: α_4 for effect of pH, β_4 for the effect of auxiliary complexing agent. Construction of Titration curves: Theory of metallochromic indicators, Masking, Demasking and kinetic masking. Types of EDTA titrations. Problems.</p>	08
6	<p>PRECIPITATION TITRATIONS Titrations involving silver salts, Detection of end points by Mohr's method, Volhard's method, Adsorption indicators. Construction of titration curves, Problems.</p>	08

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	15	10	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference books:

- 1) Quantitative Analysis by R. A. Day & A. L. Underwood, 6th ed. Pub. Prentice Hall of India ltd.
- 2) Vogel's Text Book Inorganic Quantitative Analysis, 6th ed.
- 3) Analytical Chemistry (Principles & Technique) by Lary G. Hargis
- 4) Fundamental of Analytical Chemistry by Skoog D. A. & West D. M.
- 5) Instrumental Methods of Analysis by B. K. Sharma
- 6) Instrumental analysis by R.D.Braun Mc Graw Hill
- 7) Analytical Chemistry by Gary Christian
- 8) Analytical Chemistry by Day and Underwood
- 9) Modern Analytical Chemistry by David Harvey, McGraw Hill Higher Education
- 10) College Analytical Chemistry, Mangaonkar, Teckchandani, Sathe, Ghalsasi, Jain, Himalaya Publishing House
- 11) Analytical Chemistry by Alka L. Gupta, PragatiPrakashan

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12) Instrumental Methods of Chemical Analysis by H. Kaur, PragatiPrakashan.

Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Express and calculate errors.	20%
CO-2	Observe and apply good laboratory practice.	20%
CO-3	Relate and explain various titration methods.	20%
CO-4	Correlate several redox titrations.	10%
CO-5	Discuss theories of complexometric titrations.	20%
CO-6	Analyze the precipitation titration curves.	10%

List of Open Source Software/learning website:

- <https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/>
- https://blog.feedspot.com/chemistry_websites/

SRICT Institute of Science & Research

BACHELOR OF SCIENCE

Course Code: BC2307

Course Name: PETROCHEMICALS

Semester V

Type of course: Core Course

Prerequisite: Should have basic knowledge about petrochemicals.

Rationale: At the end of the course, students will have knowledge about different types of petrochemicals and application of petrochemical products.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
2	0	0	2	70	30	-	-	100

Content:

Sr. No.	Content	Total Hrs.
SECTION-A		
1	SOURCE OF PETROCHEMICALS (a) Natural gas: Composition, Natural gas as Petrochemical feed stock. (a) Crude oil: Composition, Distillation and Refining, Utilization of various fractions (oil product).	04
2	CLASSIFICATION OF PETROCHEMICALS First, Second and Third generation petrochemicals. Conversion process: Cracking reforming, Isomerisation, Hydrogenation, Alkylation and Hydrodealkylation, Dehydrocyclisation of petroleum products, Polymerization of gaseous hydrocarbons.	04
3	EXTRACTION OF PETROCHEMICALS-I Manufacture and industrial applications of Methane: Methanol, Synthesis gas, Ammonia (C1 cut of petroleum). Manufacture and industrial applications of Ethylene: Ethanol, Acetaldehyde (Wacker-Chemie process), Ethylene Glycol (C2 cut of petroleum). Manufacture and industrial applications of Acetylene: Acrylic acid, Acrylonitrile, Vinylchloride (C2 cut of petroleum).	04
SECTION-B		
4	EXTRACTION OF PETROCHEMICALS-II Manufacture and industrial applications of Propylene: Iso propyl alcohol, Acetone (Wacker-Chemie process), Propylene oxide (Halcon process)	04

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	(C3 cut of petroleum). Manufacture and industrial applications of Butadiene: Butylalcohols, Methyl terbutyl ether (MTBE), Cyclopentadiene (C4 cut of petroleum).	
5	APPLICATION OF PETROCHEMICAL COMPOUNDS A) Industrial Fuels: Natural fuels, Synthetic fuels, Hydrogen- Fuel of tomorrow, Fuel for rocket (Hydrazine). B) Intermediates of Pharmaceuticals and Dyes: Quinoline, Sulphanilamide, H-acid, J-acid.	04
6	BTX AROMATIC Recovery process of BTX, manufacture and industrial applications of benzene, toluene, xylene, naphthalene, phenol, styrene, aniline, maleic anhydride, cyclohexanol.	04

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	15	10	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

- 1) Introduction to petrochemicals by Sukumar Maiti oxford and IBH pubs co. New Delhi.
- 2) A text on petrochemicals by Dr. B. K. Bhaskar Rao, Khanna pubs. New Delhi.
- 3) Chemicals from petroleum by A. L. Wadams (ELBS and John Murray London)
- 4) Petrochemicals by S. L. Venkatewarn (Colour pubs. Pvt. Ltd. Bombay)
- 5) Petrochemicals digest by MGK Manon (Asia Publishing house Bombay)

Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Identify sources of petrochemicals.	20%
CO-2	Explain various conversion process.	20%
CO-3	Describe petrochemicals obtained from C1 and C2 cut of petroleum.	20%
CO-4	Describe petrochemicals obtained from C3, C4 and C5 cut of petroleum.	10%
CO-5	Understand the applications of petrochemical compounds.	20%
CO-6	Compare the properties & application of BTX aromatic compounds.	10%

List of Open Source Software/learning website:

- <https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/>
- https://blog.feedspot.com/chemistry_websites/

SRICT Institute of Science & Research
BACHELOR OF SCIENCE
Course Code: BC2306
Course Name: Chemistry Practical - III
Semester V
Type of course: Core Course
Prerequisite: Should have basic knowledge about lab utilities and its applications.

Rationale: At the end of the course, students will have knowledge about organic separations, gravimetric estimations and physical instruments.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
0	0	4	2	-	-	70	30	100

Content:

Sr. No.	Content	Total Hrs.
SECTION-A		
1	INORGANIC QUALITATIVE ANALYSIS-I	12
2	VOLUMETRIC TITRATIONS	08
3	ORGANIC ESTIMATIONS-I	04
SECTION-B		
4	INORGANIC QUALITATIVE ANALYSIS-I	12
5	ORGANIC ESTIMATIONS-II	08
6	PHYSICAL CHEMISTRY PRACTICALS	04

Reference Books:

1. A text book of practical organic chemistry – A. I. Vogel
2. Practical organic Chemistry – Mann and Saunders
3. Comprehensive Practical Organic Chemistry: Preparations and Quantitative Analysis V K Ahluwalia & R. Aggarwal Universities Press.
4. An Advance Course in practical Chemistry, A K. Nad, B. Mahapatra and A. Ghoshal.
5. Advanced Practical Inorganic Chemistry, Gurdeepraj, Goel Publishing House, 2001.
6. An Advanced Course in Practical Chemistry, A.K. Nad, B. Mahapatra, A. Ghosal, New Central Book Agency, 2004.
7. Practical physical chemistry –J.B. Yadav
8. Practicals in physical chemistry – P.S.Sindhu
9. Experimental physical chemistry – R.C.Das, B.Behera
10. Analytical Chemistry Practice, John H. Kennedy, Saunders College Publishing, Second Edition 1990.

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Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Recognize the type of inorganic compound.	20%
CO-2	Solve volumetric titration.	20%
CO-3	Analyze the organic compound.	10%
CO-4	Identify the type of inorganic compound.	20%
CO-5	Analyze the organic compound.	20%
CO-6	Justify the physical properties.	10%

List of Open Source Software/learning website:

- <https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/>
- https://blog.feedspot.com/chemistry_websites/

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**B.Sc. Sem. VI
Teaching/Exam Scheme**

w.e.f.:

Sr. No.	Course code	Category of course	Course title	Hours Per week			Tot. Con. hrs.	Credits	E	M	I	V	Total Marks
				L	T	P							
1	BC2309	Foundation Compulsory	Basics of Communication Skills-II	2	-	-	2	2	70	30	-		100
2	BC2310	Core Course	Chemistry-XIII	4	-	-	4	4	70	30			100
3	BC2311	Core Course	Chemistry-XIV	4	-	-	4	4	70	30			100
4	BC2312	Core Course	Chemistry-XV	4	-	-	4	4	70	30			100
5	BC2313	Core Course	Chemistry-XVI	4	-	-	4	4	70	30			100
6	BC2314	Core Course	Chemistry Practical – IV	-	-	4	4	2			30	70	100
7	BC2315	Generic Elective	Sustainable Chemistry	2	-	-	2	2	70	30	-		100
8	BC2316	Compulsory Elective	Seminar	1	-	-	1	1	50	-	-		50
			Total	21	0	4	25	23	470	180	30	70	750

Generic Elective	3. Petrochemicals 4. Sustainable Chemistry
Compulsory Elective	Seminar

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BACHELOR OF SCIENCE

Course Code: BC2309

Course Name: Basics of Communication Skills-II

Semester: VI

Type of course: Foundation Compulsory

Prerequisite: Zeal to learn the subject.

Rationale: The rationale of the curriculum is to help students to express their original ideas in English and also develop interest in language and literature with a focus on comprehension, and reading, speaking and writing skills.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
2	-	-	2	70	30	-	-	100

Content:

Sr. No.	CONTENT	Total Hrs.
SECTION-A		
1	Text: Gems of Wisdom 1.The Model Millionaire 2.Too Dear 3.The Ant and The grasshopper 4.The Diamond Necklace	06
2	Report Writing (Press Reports) Suggested topics: Accidents, Natural Calamities and the Celebration of Festivals	04
3	Comprehension based on News Items N.B.: News items should be of about 225 words based on – sports events, events of local interest and international events.	03
SECTION-B		
4	Grammar: Reported Speech Turning the sentences into direct and indirect speech of narration	04
5	Grammar: Active &Passive Voice Usage	04
6	Writing: Paragraph &Email Writing	03

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Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	15	10	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom’s Taxonomy)

Reference Books:

1. Gems of Wisdom_ (Macmillan Education)
2. David Green: Contemporary English Grammar Structure and Usage
3. M L Tickoo and Subramanian: Intermediate Grammar, Usage and Composition
4. Wren and Martin – High School English Grammar and Composition

Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Use English in day-to-day communication	20%
CO-2	Use various forms of vocabulary in varied situations in oral and written communication.	20%
CO-3	Comprehend the dynamics of various rules of grammar and check its validation while they speak and write language correctly	20%
CO-4	Use grammar effectively to make themselves competent Listener, Speaker, Reader and Writer by exposing to various set of situations	10%
CO-5	Write various formal and informal documents of day to day life	20%
CO-6	Prepare for lifelong learning and enjoyment of English Language and literature.	10%

List of Open Source Software/learning website:

- <http://www.english-online.org.uk/>
- <http://www.learnenglish.de/>

SRICT Institute of Science & Research
BACHELOR OF SCIENCE
Course Code: BC2310
Course Name: Chemistry-XIII (INORGANIC CHEMISTRY)
Semester VI
Type of course: Core Course

Prerequisite: Should have basic knowledge about metal complex in inorganic chemistry.

Rationale: At the end of the course, students will have knowledge about molecular symmetry, hybridization, reactions of coordination complexes, organometallic compounds, and bio-inorganic compounds.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	0	4	70	30	-	-	100

Content:

Sr. No.	CONTENT	Total Hrs.
SECTION-A		
1	MOLECULAR SYMMETRY Introduction and importance of symmetry, Symmetry elements and Symmetry operations, Classification of molecules in to point groups. Point group of simple molecules like CO ₂ , HCl, H ₂ O, NH ₃ , BF ₃ , [PtCl ₄] ⁻² , PF ₅ , C ₆ H ₆ , C ₅ H ₅ ⁻ , CH ₄ , SF ₆ , Cis and Trans - Dichoroethylene (C ₂ H ₂ Cl ₂), Staggered and Eclipsed Ethane (C ₂ H ₆).	08
2	HYBRIDISATION AND SHAPES OF COVALENT MOLECULES Hybridisation, Salient features of phenomenon of hybridisation. VSPER Theory, geometry of covalent molecules, Geometry of molecules containing only bond pairs of electrons – BF ₂ , BF ₃ , CH ₄ , PF ₅ , SF ₆ , and IF ₇ molecules. Geometry of molecules containing bond pairs as well as lone pair of electrons- NH ₃ , H ₂ O, SF ₄ , XeF ₂ , XeF ₄ .	08
3	SUBSTITUTION REACTIONS OF OCTAHEDRAL COMPLEXES Reaction mechanisms of ligand substitution in octahedral complexes (i) S _N ¹ (ii) S _N ² , Acid hydrolysis & Base Hydrolysis-Redox (Single Electron Transfer) reactions, Substitution reaction without breaking M-L bond.	08
SECTION-B		
4	ORGANOMETALLIC CHEMISTRY AND CATALYSTS Organometallic compounds. Ligands in organometallic compounds. 18-	08

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	Electron rule-applications and limitations. Preparation, properties, Structure and bonding in ferrocene, and Zeise's salt. Hydrogenation of olefins-Wilkinson's catalyst - Ziegler-Natta catalyst.	
5	INORGANIC POLYMERS Inorganic Polymers - general properties, important inorganic polymer. Phosphorous based polymers - Phosphorous based Chain and network polymers - preparation structures and uses. Polymers containing Boron - Preparation, reactions, uses and structure of borazine & Boron nitride.	08
6	BIO - INORGANIC CHEMISTRY Metallo biomolecules – classification, Structure and functions of hemoglobin, myoglobin, Metalloenzymes: Carbonic anhydrase, Carboxy peptidase, and peroxidase. Role of alkali and alkaline earth metal ions in biological system. Biological fixation of nitrogen.	08

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	15	10	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

- 1) Introduction to quantum chemistry, by A. K. Chandra, Tata Mc.Graw Hill, Delhi.
- 2) Quantum mechanics in chemistry by M. H. Hanna
- 3) Theoretical Inorganic chemistry by Day & Selbin , Affiliated East West Publ. Pvt. Ltd.
- 4) Advanced Inorganic Chemistry by Cotton and Wilkinson, John Wiley. Uni. Chemistry by B. H. Mohan
- 5) Structural Inorganic chemistry by A. F. Wells.
- 6) Chemical Bonding - an introduction By Rawal, Patel & Patel.
- 7) Environmental Chemistry by Amritha anand and Sugumar.
- 8) Basic Inorganic Chemistry by Cotton and Wilkinson
- 9) A Text book of Inorganic Chemistry by P.L.Soni
- 10) Introduction to Inorganic Chemistry by Durrant and Durrant
- 11) Modern Co-ordination Chemistry by R. Lewis and R.G. Wilkinson.
- 12) Inorganic Chemistry- Principles of structure and reactivity by J.E. Huhhey and E.A. Keiter.
- 13) Application of Group Theory to Chemistry by P.K.Bhattacharya., Himalaya PublishingHouse, Mumbai.
- 14) Quantum Rasayan, University Granth Nirman Board (Gujarat).
- 15) Environmental Chemistry by A.K. De.
- 16) The corrosion and oxidation of metals by Evans U.R. (1961), Arnold, London.
- 17) Corrosion, Causes and Prevention, Speller. F.,Mc Grqw Hill,New york.

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18) Dhatvik Ksharan, Part-I & II by M.N. Desai, Uni. Granth Nirman Board (Gujarat).

19) Corrosion and Corrosion Control, Uhlig H., Wiley.

20) Corrosion Engineering by Fontana M.G. and Green N.D., Mc Graw

Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the concept of molecular symmetry and calculate the point group.	20%
CO-2	Identify the shape of inorganic compounds using VSEPR Theory	20%
CO-3	Illustrate the concepts of substitution reaction in octahedral complexes.	20%
CO-4	Explain the applications of organometallic compounds.	10%
CO-5	Define the properties and importance of inorganic polymers	20%
CO-6	Describe the biological functions of inorganic metals.	10%

List of Open Source Software/learning website:

- <https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/>
- https://blog.feedspot.com/chemistry_websites/

SRICT Institute of Science & Research
BACHELOR OF SCIENCE
Course Code: BC2311
Course Name: Chemistry-XIV (ORGANIC CHEMISTRY)
Semester VI
Type of course: Core Course
Prerequisite: Should have basic knowledge about reactions and natural products.

Rationale: At the end of the course, students will have knowledge about molecular rearrangement, organic polymers, plant pigments, drugs and spectroscopy.

Teaching and Examination Scheme:

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	0	4	70	30	-	-	100

Content:

Sr. No.	CONTENT	Total Hrs.
SECTION-A		
1	MOLECULAR REARRANGEMENTS Mechanism of rearrangements involving C to C migrations as illustrated by Wagner-Meerwein and Pinacol-Pinacolone rearrangements. Mechanism of rearrangements involving C to N migrations as illustrated by Hoffmann, and Curtius, rearrangements.	08
2	POLYMERS 1. Synthetic Polymer:-Basic concepts, Classification of Polymer. Mechanism of Addition polymerization: free radical polymerization and Ionic polymerization. Condensation Polymerization: Polyesters (Terylene), Polyamides (Nylon-6,12). Thermoplastic and Thermosetting Polymer, Natural and Synthetic Rubbers. 2. Biodegradable polymers- Introduction, classification and application, Polylactic acid and polyglycolic acid.	08
3	PLANT PIGMENTS: Classification - General introduction of Carotenoids. Analytical and synthetic evidence of β -carotene - General introduction of anthocynines and anthocyanidines. Analytical and Synthetic evidences of cyanidine chloride - Introduction of flavones and flavonols. General method of determining. Structure of flavones.	08

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SECTION-B		
4	TERPENES Terpenes: Introduction, Classification, Properties, Occurrence and isolation of terpenes. Isoprene rule. Preparation, Properties, Uses, Structural elucidation: Citral, Geraniol, Camphor.	08
5	SYNTHETIC DRUGS Classification, based on pharmacological action, synthesis and uses of Amylnitrate, Chloroquine, Pyrimethamine, Sulpha Pyrimidine, Diazepam, Lidocaine, Chlorpropamide, Dapsone, Isoniazide, 5-Fluoro Uracil.	08
6	MASS SPECTROMETRY Mass spectroscopy: basic principles of mass spectrum - molecular peak - base peak - isotopic peak - meta stable peak - types of fragmentation - factors influencing the fragmentation - Mc-Lefferty rearrangement – applications - Finger print application of mass spectra.	08

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	15	10	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference Books:

- 1) Mechanism and Structure in organic chemistry-Goulde. S.
- 2) Reaction mechanism in organic chemistry by Mukhargy & Singh
- 3) Principles of reaction mechanism in organic chemistry by Dharmaraha & Chawla
- 4) Organic reaction mechanism by Bansal Tata Mac. Hill
- 5) Organic Chemistry (Vol I & II) 6 th Edn, I. L. Finar.
- 6) Organic Chemistry by Hendrickson, Cram & Hammond
- 7) Organic Chemistry by Brown R. F.
- 8) Organic Chemistry by Solomon W. Graham
- 9) Principles of Organic Synthesis- R. O. C. Norman
- 10) Basic Principles of Organic chemistry, by R. Y. Caserio, W. A. Benjamin
- 11) May's Chemistry of synthetic Drugs by Dyson.
- 12) Chemistry of drugs, Ener and Caldwell
- 13) Synthetic drugs by Tyagi and Yadav.
- 14) Synthetic Organic Chemistry by O. P. Agarwal
- 15) Organic Chemistry by Morrison and Boyd.
- 16) Chemistry of organic Natural Product Vol. I & II by O. P. Agarwal.
- 17) Chemistry of synthetic drugs by Trivedi

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- 18) Principles of Medicinal Chemistry Vol. I & II by S. S. Kadam, K. R. Mahadik, K. G. Bothara (Nirali Prakashan)
- 20) Organic reactions & their mechanism by P. S. Kalsi, New age international publishers
- 22) Organic Chemistry, 8th edition by Paula Yurkanis Bruice, University of California, Santa Barbara.

Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Relate the concepts of various molecular rearrangement.	20%
CO-2	Classify the different synthetic and biodegradable polymers.	20%
CO-3	Explain the plant pigments and their structural elucidation.	20%
CO-4	Discuss the various properties and isolation of Terpenes.	10%
CO-5	Recognize the pharmacological actions and synthesis of various synthetic drugs.	20%
CO-6	Understand the basic concept of MASS Spectrometry.	10%

List of Open Source Software/learning website:

- <https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/>
- https://blog.feedspot.com/chemistry_websites/

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BACHELOR OF SCIENCE

Course Code: BC2312

Course Name: Chemistry-XV (PHYSICAL CHEMISTRY)

Semester VI

Type of course: Core Course

Prerequisite: Should have basic knowledge about reactions and law involved in physical chemistry.

Rationale: At the end of the course, students will have knowledge about characteristics of sol, nanomaterial, mass spectrometry and nuclear reactions.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	0	4	70	30	-	-	100

Content:

Sr. No.	CONTENT	Total Hrs.
SECTION-A		
1	COLLOIDS Introduction - Types of colloidal system – Lyophilic and Lyophobic sols – Characteristics of Lyophilic and Lyophobic sols – Comparison of Lyophilic and Lyophobic sols – Preparation of sols – Purification of sols – Optical properties of sol – Kinetic properties of sol – Applications of colloids. Micelle formation – Shape and structure of Micelle - Critical micelle concentration (CMC).	08
2	PHASE EQUILIBRIA-II Phase equilibria of two component system-simple eutectic, Pb Ag systems, desilverisation of lead, KI- Water system, freezing mixtures. Solid solutions: compounds with congruent and incongruent melting point (Only definition and example), Three component solid-liquid systems.	08
3	NANOCHEMISTRY Definition - size dependent properties: magnetic, electrical and optical properties - Synthesis of nanomaterials - bottom-up and top-down approaches - thin film deposition - catalytic assisted growth - chemical vapour deposition - sol gel method - chemical reduction Fullerenes - carbon nanotubes - single walled and multi walled nano tubes - Applications of nanoscience and nanotechnology.	08

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SECTION-B		
4	BINARY LIQUID MIXTURES Liquid-liquid mixtures, ideal liquid mixtures, Raoult's law, non-ideal or real solutions, positive and negative deviations from Raoult's law, temperature composition curves for ideal and non-ideal binary solutions of miscible liquids, azeotropes, partially miscible liquids: Phenol-water systems, immiscible liquids, steam distillation, Chemical Potential of Ideal and non-ideal solutions.	08
5	SURFACE CHEMISTRY Adsorption - physisorption and chemisorptions - adsorption of gases by solids - adsorption isotherms - Freundlich adsorption isotherm - derivation of Langmuir adsorption isotherm, statement and explanation of BET isotherm - applications of adsorption - determination of surface area - adsorption indicators.	08
6	NUCLEAR REACTIONS: Nuclear reactions – Nuclear Fission and Fusion reaction – Nuclear equation – Energy released in Nuclear reaction - Mass defect – Nuclear Binding energy – Nuclear Fission process – Nuclear chain reaction – Atomic Bomb – Nuclear reactor - Hydrogen bomb. Numerical problems.	08

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	15	10	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

REFERENCE BOOKS:

- 1) Essentials of Physical Chemistry by Bahl and Bahl.
- 2) Physical chemistry by G.M. Barrow.
- 3) Physical chemistry by W. Moore.
- 4) Physical chemistry by Atkins.
- 5) Physical chemistry by G.K.Vemulapalli.
- 6) Physical chemistry by B.K.Sharma.
- 7) Physical chemistry by Gurdeep raj.
- 8) Physical chemistry by Puri, Pathania, Sharma.
- 9) Physical Chemistry by D.N. Bajpai.
- 10) Physical chemistry by Negi and Anand.
- 11) Physical chemistry by K.L. Kapoor Vol 1-5.
- 12) Nanochemistry by G.B. Sergeev.
- 13) Physical chemistry by Dr. S. Pahari.
- 14) Nuclear chemistry by Arnikar.

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15) Electro chemistry by S. Glasstone.

16) Electrochemistry by B.K.Sharma.

17) Modern Electrochemistry by J'omBockris and Redd.

Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	State properties and application of colloids.	20%
CO-2	Describe the components of Phase equilibria.	20%
CO-3	Illustrate the synthetic methods for nano materials.	20%
CO-4	Evaluate the law of binary liquid mixture.	10%
CO-5	Understand the theories of adsorption.	20%
CO-6	Discuss the various types of nuclear reactions and their applications.	10%

List of Open Source Software/learning website:

- <https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/>
- https://blog.feedspot.com/chemistry_websites/

SRICT Institute of Science & Research
BACHELOR OF SCIENCE
Course Code: BC2313
Course Name: Chemistry-XVI (ANALYTICAL CHEMISTRY)
Semester VI
Type of course: Core Course
Prerequisite: Should have basic knowledge about spectroscopy and chromatography.

Rationale: At the end of the course, students will have knowledge about spectroscopy and chromatographic techniques.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
4	0	0	4	70	30	-	-	100

Content:

Sr. No.	Content	Total Hrs.
SECTION-A		
1	GRAVIMETRIC ANALYSIS Factors affecting solubility of precipitates. (1) Common ion (2) Diverse ions (3) pH (4) Hydrolysis (5) Complex formation (With Numerical problems). The precipitation process, Nucleation growth. Von Weimarn's theory of relative super saturation. Digestion of precipitates Factor affecting quality of precipitate: Coprecipitation and post precipitation Precipitation from homogeneous solution with illustration of Barium and Aluminum.	08
2	SPECTROSCOPY-I Types of spectrum, Process involved in interaction with matter (Fluorescence, Phosphorescence), Components of Spectrophotometer- Sources, Grating and Prism as dispersing device, Sample handling, Detectors- Photo tube, Photomultiplier tube. Block diagram and working of single beam and double beam spectrophotometer.	08
3	SPECTROSCOPY-II Ultra-violet and Visible Spectroscopy: Basic principles of instrumentation (choice of source, monochromator and detector) for single and double beam instrument; Basic principles of quantitative analysis. Application of UV in various fields. Raman Spectroscopy: Introduction to Raman Spectroscopy and its applications.	08

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SECTION-B		
4	<p>THERMO GRAVIMETRIC ANALYSIS Principle, Instrumentation, Determination of purity and thermal stability of primary and secondary standards, determination of correct drying temperature, determination of curie point, automatic determination of mixtures, analysis of alloys Characteristics of TGA curves- $\text{CaC}_2\text{O}_4 \cdot \text{H}_2\text{O}$, $\text{CaSO}_4 \cdot 5\text{H}_2\text{O}$. Applications, Factors affecting TGA curves.</p>	08
5	<p>LIQUID CHROMATOGRAPHY Introduction of TLC. Limitation of conventional liquid chromatography (no detail method), technique of HPLC, elementary idea about technique and layout diagrams of instrument, components of instrument of HPLC technique.</p>	08
6	<p>GAS CHROMATOGRAPHY Classification of chromatography, Principles of GC separation. Components of GC, Sample introduction system, Columns: Packed column Capillary Column (WCOT, SCOT), Carrier gas and its selection-stationary phases: Solid adsorbents, Inert supports (Selection criteria, Diatomaceous earths) and liquid stationary phases, Detectors: FID, TCD, Qualitative and quantitative analysis using GC.</p>	08

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	15	10	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom's Taxonomy)

Reference books:

- 1) Quantitative Analysis by R. A. Day & A. L. Underwood, 6 th ed. Pub. Prentice Hall of India ltd.
- 2) Vogel's Text Book Inorganic Quantitative Analysis, 6 th ed.
- 3) Analytical Chemistry (Principles & Technique) by Lary G. Hargis.
- 4) Fundamental of Analytical Chemistry by Skoog D. A. & West D. M.
- 5) Holler F.J. Instrumental Methods of Analysis by B. K. Sharma.
- 6) Instrumental analysis by R.D.Braun Mc Graw Hill.
- 7) Analytical Chemistry by Gary Christian Instrumental methods of chemical analysis Dr.H.Kaur. Pragati prakashan Meerut.
- 8) College Analytical Chemistry by Mangaonkar, Teckchandani, Sathe, Ghalsasi, Jain (Himalaya Publication House).

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Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Analyze the methods involved in gravimetric analysis.	20%
CO-2	Illustrate the principle components of spectrophotometer.	20%
CO-3	Understand the working principles of UV-Visible and Raman spectroscopy.	20%
CO-4	Explain the instrumentation and applications of TGA	10%
CO-5	Describe the principles and components of liquid chromatography.	20%
CO-6	Express the principles and components of gas chromatography.	10%

List of Open Source Software/learning website:

- <https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/>
- https://blog.feedspot.com/chemistry_websites/

SRICT Institute of Science & Research
BACHELOR OF SCIENCE
Course Code: BC2315
Course Name: SUSTAINABLE CHEMISTRY
Semester VI
Type of course: Core Course
Prerequisite: Should have basic knowledge about green chemistry.

Rationale: At the end of the course, students will have knowledge about importance of green chemistry, green catalyst, and different synthetic routes of green chemistry.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
2	0	0	2	70	30	-	-	100

Content:

Sr. No.	Content	Total Hrs.
SECTION-A		
1	INTRODUCTION TO SUSTAINABLE CHEMISTRY Fundamental: Basic Concepts of Sustainable Chemistry; Sustainability assessment; Essentials of sustainable chemistry; Role of chemistry in sustainability.	04
2	GREEN CHEMISTRY FOR SUSTANABILITY Introduction - Green chemistry - relevance and goals - Anastas' twelve principles of green Chemistry - Planning of green chemistry: Atom economy, alternative starting materials, solvents, reagents, catalysts, energy source.	04
3	GREEN SYNTHESIS USING BASIC PRINCIPLE OF GREEN CHEMISTRY Introduction – Synthesis of Adipic acid, Adiponitrile, Ibuprofen, Alcohol, Aromatic Nitriles, Quinoxallines, Cyclohexane Oxime, Lauryllactam, 1-acetylnapthalene.	04
SECTION-B		
4	VALUE ADDITION TO WASTE BIOMASS Renewable Feed stocks; Types of biomass derived fuels & energy, biogas, bioethanol, biodiesel; Introduction to waste to energy (Thermochemical conversion, gasification pathway, pyrolysis pathway); Biochemical Conversion, fermentation.	04

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5	RENEWABLE ENERGY Environmental consequences of fossil fuel use, Importance of renewable sources of energy, Sustainable Design and development, Types of RE sources, Limitations of RE sources-Power in the Wind – Types of Wind Power Plants (WPPs)–Components of WPPs-Working of WPPs – Hydrogen as green fuel.	04
6	RECYCLING AND CIRCULAR ECONOMY: Plastic recycling in circular economy. Sustainable packaging. Life Cycle Analysis (LCA), Cradle to grave and Cradle to Cradle design. Circular economy. Introduction to carbon credit, carbon capture and Environmental, Social and Governance (ESG).	04

Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
10	15	15	10	10	10

Legends: R: Remembrance; U: Understanding; A: Application, N: Analyze and E: Evaluate C: Create and above Levels (Revised Bloom’s Taxonomy)

Reference books:

1. Green Chemistry – Environmentally benign reactions – V. K. Ahluwalia. Ane Books India (Publisher). (2006).
2. Introduction to Green Chemistry: Albert S. Matlack, 2nd edition, CRC Press.
3. Waste to Wealth-The circular economy advantage: Peter Lacy and Jakob Rutqvist, Ma Editions.
4. Green Solvents-Ionic Liquids: Paul T. Anastas (Series Editor), Peter Wasserscheid, Annegret Stark, Wiley-VCH.
5. Sustainable chemistry: G. Reniers and C.A Brebbia, WIT Press.
6. Valorization of biomass to value added commodities: Daramola, Michael, Ayeni, and Augustine (Eds), Springer.

Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the basic concepts of sustainable chemistry.	20%
CO-2	Apply the concepts of green chemistry for sustainable development.	20%
CO-3	Prepare the organic compounds using principles of green chemistry.	20%
CO-4	Relate the various types of bio-fuels.	10%
CO-5	Explain different types of renewable energy.	20%
CO-6	Define the concepts of recycling and circular economy.	10%

List of Open Source Software/learning website:

- <https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/>
- https://blog.feedspot.com/chemistry_websites/

SRICT Institute of Science & Research
BACHELOR OF SCIENCE
Course Code: BC2314
Course Name: Chemistry Practical - IV
Semester VI
Type of course: Core Course
Prerequisite: Should have basic knowledge about lab utilities and its applications.

Rationale: At the end of the course, students will have knowledge about organic separations, gravimetric estimations and physical instruments.

Teaching and Examination Scheme:

Teaching Scheme			Credits C	Examination Marks				Total Marks
L	T	P		Theory Marks		Practical Marks		
				ESE (E)	PA (M)	ESE (V)	PA (I)	
0	0	4	2	-	-	70	30	100

Content:

Sr. No.	Content	Total Hrs.
SECTION-A		
1	ORGANIC SEPARATION-I	12
2	GRAVIMETRIC ESTIMATIONS	08
3	PHYSICAL EXERCISE-I	04
SECTION-B		
4	ORGANIC SEPARATION-II	12
5	CHROMATOGRAPHY	08
6	PHYSICAL EXERCISE-II	04

Reference Books:

1. A text book of practical organic chemistry – A. I. Vogel.
2. Practical organic Chemistry – Mann and Saunders.
3. Comprehensive Practical Organic Chemistry: Preparations and Quantitative Analysis V K Ahluwalia & R. Aggarwal Universities Press.
4. An Advance Course in practical Chemistry, A K. Nad, B. Mahapatra and A. Ghoshal.
5. Advanced Practical Inorganic Chemistry, Gurdeepraj, Goel Publishing House, 2001.
6. An Advanced Course in Practical Chemistry, A.K. Nad, B. Mahapatra, A. Ghosal, New Central Book Agency, 2004.
7. Practical physical chemistry –J.B.Yadav.
8. Practicals in physical chemistry – P.S.Sindhu.
9. Experimental physical chemistry – R.C.Das, B.Behera.

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10. Analytical Chemistry Practice, John H. Kennedy, Saunders College Publishing, Second Edition 1990.

Course Outcomes: After completing the course students will be able to

Sr. No.	CO statement	Marks % weightage
CO-1	Recognize the type of organic compound.	20%
CO-2	Calculate the amount of ions present in the inorganic mixture.	20%
CO-3	Identify and interpret the application of physical instrument.	20%
CO-4	Identify and inspect the type of organic compound.	10%
CO-5	Apply the knowledge of chromatography techniques.	20%
CO-6	Justify the physical properties.	10%

List of Open Source Software/learning website:

- <https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/>
- https://blog.feedspot.com/chemistry_websites/