

**SRICT Institute of Science & Research**
**Teaching/Exam Scheme**
**M.Sc. Sem. I**

Sr. No.	Subject Code	Category of course	Course title	Hours Per week		Total con. hrs.	Cred its	E	M	I	V	Total Marks
				L	P							
1	MC3101	Core Course	Inorganic Chemistry –I	3	-	3	3	70	30	-	-	100
2	MC3102	Core Course	Organic Chemistry –I	3	-	3	3	70	30	-	-	100
3	MC3103	Core Course	Physical Chemistry-I	3	-	3	3	70	30	-	-	100
4	MC3104	Core Course	Analytical Chemistry – I	3	-	3	3	70	30	-	-	100
5	MC3105	Open Elective-I	Environment for Chemists	3	-	3	3	70	30	-	-	100
6	MC3106	Open Elective-II	Fundamental of Biochemistry	3	-	3	3	70	30	-	-	100
7	MC3107	Core Course	Practicals in chemistry	-	18	18	9	-	-	60	140	200
Total				18	18	36	27	420	180	60	140	800

Open Elective -I	1.Environment for Chemists 2. Theoretical and Computational Chemistry
Open Elective -II	1.Fundamental of Biochemistry 2. Basics of Industrial Chemistry

**SRICT Institute of Science & Research**
**Master of Science**
**Subject Code: MC3101**
**Subject Name: Inorganic Chemistry**
**Semester I**
**Type of course: Core Course**

**Prerequisite:** Should have basic knowledge about shape, hybridization and identification of molecule

**Rationale:** At the end of the course, students will have knowledge about various theories related to the shape, its symmetry properties, its group theories, bonding, properties and application of Metal complexes

**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)	
3	0	0	3	70	30	-	-	100

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	<b>Stereochemistry And Bonding in main Group Compounds:</b> VSEPR, Walsh Diagrams (tri-and penta- atomic molecules), d-p bonds, Bent rule and energetics of hybridization, Some simple reactions of covalently bonded molecules.	08
2	<b>Metal – <math>\pi</math> Complexes:</b> Metal carbonyls, structure and bonding, Vibrational spectra of metal carbonyls for bonding and structural elucidation, importance of metal carbonyls. Preparation, bonding, structure and reaction of transition metal nitrosyl, dinitrogen and dioxygen complexes, tertiary phosphine as ligand.	08
3	<b>Metal –Ligand Bonding:</b> Limitation of crystal field theory, Molecular orbital theory, Octahedral, Tetrahedral and Square planar complexes, Bonding and Molecular orbital theory.	08
<b>SECTION-B</b>		
4	<b>Symmetry of Molecules:</b> Introduction and importance of symmetry, symmetry elements and symmetry operations, classification of molecules into symmetry point groups. point group of simple molecules	08

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	like CO <sub>2</sub> , HCl, H <sub>2</sub> O, NH <sub>3</sub> , BF <sub>3</sub> , [PtCl <sub>4</sub> ] <sup>2-</sup> , PF <sub>5</sub> , Cis- and Trans-dichloro ethylene (C <sub>2</sub> H <sub>2</sub> Cl <sub>2</sub> ), Staggered and Eclipsed-Ethane (C <sub>2</sub> H <sub>6</sub> ), C <sub>6</sub> H <sub>6</sub> , C <sub>5</sub> H <sub>5</sub> <sup>-</sup> , CH <sub>4</sub> and SF <sub>6</sub>	
<b>5</b>	<b>Group Theory In Chemistry and Its applications</b> :Representation of Groups: Preparation of matrices and vectors matrix notations for geometrical transformations, orthogonality theorem and its consequences, reducible and irreducible representations and their relation, preparation of character table for C <sub>2v</sub> and C <sub>3v</sub> point groups, Application of group theory to- Transformation properties of atomic crystals	<b>10</b>
<b>6</b>	<b>Metals in Medicine:</b> Metals in Medicine, Metal Deficiency and disease, Toxic Effects of metals, metals used for diagnosis and Chemotherapy with particular reference to anticancer drugs	<b>06</b>

**Suggested Specification table with Marks (Theory):**

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
<b>10</b>	<b>15</b>	<b>15</b>	<b>10</b>	<b>10</b>	<b>10</b>

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

**Reference Books:**

1. Chemical applications of group theory by F. A. Cotton (Second edition), Wiley Eastern Limited, 1976 New Delhi.
2. Group theory and its applications by P. K. Bhattacharya, Himalaya Publishing Hours, Mumbai, 1986.
3. Mechanism of Inorganic Reactions by F. Basolo and R. G. Pearson, Second Edition, Wiley Eastern Limited, New Delhi, 1977.
4. Advanced Inorganic Chemistry by F. A. Cotton and R. G. Wilkinson, John Wiley & Sons, N. Y.
5. Principles of Inorganic Chemistry, by Puri. Sharma and Kalia, 33<sup>rd</sup> Edition, Vishal publishing Co. Jalandhar, Delhi, 2017.
6. Advanced Inorganic Chemistry, Volume-II by Gurudeep Raj, Krishna Prakashan Media Ltd., Meerut.
7. Inorganic Chemistry by Gary L. Miessler and Donald A. Tarr, Pearson Education International.

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

Sr. No.	CO statement	Marks % weightage
CO-1	Describe the structure , hybridization, bonding and energy	20%

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	diagram of the molecule	
CO-2	Construct basic and fundamental of metal $\pi$ complexes, its structure, bonding, synthesis and properties	20%
CO-3	Apply fundamental theories such as CFT, VBT, MOT, LFT for the octahedral, tetrahedral, square planar complexes	20%
CO-4	Deduce structure of the molecules, its representation	10%
CO-5	Explain properties related to the symmetry, vibrational and rotational spectra	20%
CO-6	Develop approach for medicinal 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/](https://blog.feedspot.com/chemistry_websites/)

**Prepared By: Dr. Jyotindra Mahyavanshi**

**HOD – Dr. Deepika Shah**

SRICT Institute of Science & Research

Master of Science

Subject Code: MC3102

Subject Name: Organic Chemistry

Semester: - I

Type of course: Core Course

**Prerequisite:** Should have knowledge about nomenclature, reactivity, mechanism of some basic reaction and their application.

**Rationale:** At the end of the course, Students will have knowledge about various reaction mechanism, stereo-chemical aspects, conformation of molecules and aromaticity of compounds

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)	
3	0	0	3	70	30	-	-	100

Content:

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	<b>Reaction Mechanism &amp; Reactive Intermediates-I:</b> Detailed study of organic reaction intermediates. Generation, structure, stability and reactions of – Carbocations (Classical and non-classical): Phenonium ion, norbornyl system, Carbocation rearrangements- Demjanov, Pinacole-Pinacolone. Carbanions: Mechanism of condensation involving enolates - Aldol, Dieckmann.	08
2	<b>Reaction Mechanism &amp; Reactive Intermediates-II:</b> Carbenes: Mechanism of Arndt-Eistert reaction, Reimer-Tiemann reaction Free Radicals: Allylic halogenation (NBS), coupling of alkenes and arylation of aromatic compounds by diazonium salts. Sandmeyer reactions. Free radical rearrangements, Hunsdiecker reaction.	08
3	<b>Aromaticity and Aromatic character:</b> Structure and stability of benzene, Frost circle diagram, Concept of aromaticity; Resonance and Chemical stabilization; Criteria to check aromatic character-IR, NMR, heat of hydrogenation; Huckel's rule; HMO method, Antiaromaticity, Homoaromaticity, Nonaromaticity; Aromaticity in benzenoid	08

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	compounds: naphthalene, pyrene, Aromaticity in non-benzenoid compounds: Azulene, Tropolones, charged rings annulenes, Fullerenes, and Mesoionic compounds.	
<b>SECTION-B</b>		
<b>4</b>	<b>Stereochemistry</b> : Stereo chemical principles; Enantiomeric relationships; Distereomeric relationship; R-S and E-Z nomenclature; Chiral-Prochiral relationships; Stereo selective and Stereo specific reactions; Resolution of racemic mixture, Optical activity in the absence of chiral carbons biphenyl, allenes, spiranes.	<b>08</b>
<b>5</b>	<b>Conformational Analysis</b> : Inter-conversion of Fischer, Newman and Sawhorse projections. Newer method of asymmetric synthesis (including enzymatic and catalytic nexus), enantio and diastereo selective synthesis. Simple acyclic and cyclic (chair and boat cyclohexanes, Decalins, Perhydrophenanthrene) systems. Effects of conformation on reactivity in acyclic compounds and substituted cyclohexanes.	<b>08</b>
<b>6</b>	<b>Name reaction</b> : Organic Name Reactions: General nature, Route of synthesis, method, mechanism and synthetic applications of the following reactions: Heck reaction, Suzuki reaction Dakin reaction, Sonagashira reaction, Buchwald-Hartwig reaction, Bayer-villiger oxidation, Baker-venkataraman reaction, Birch Reduction, Wilkinson reduction	<b>08</b>

**Suggested Specification table with Marks (Theory):**

<b>Distribution of Theory Marks</b>					
R Level	U Level	A Level	N Level	E Level	C Level
<b>10</b>	<b>15</b>	<b>15</b>	<b>10</b>	<b>10</b>	<b>10</b>

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

**Reference Books:**

1. Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry March, John Wiley.
2. Organic Chemistry (5/e) by Morrison & Boyd (Prentice Hall).
3. Advanced Organic Chemistry by Carey & Sundberg (3<sup>rd</sup> edition).
4. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
5. Advanced Organic Chemistry, F. A. Carey and R. J. Sandburg, Plenum.
6. Organic chemistry 2nd ed. Jonathan clayden, Nick Greeves, Stuart Warren.
7. Reaction Mechanism and Reagents in Organic Chemistry by C. R. Chatwal (Himalaya Publishing House, Bombay, 1987).

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8. Stereochemistry of Carbon Compounds; By Ernest L. Eliel, Published by Tata McGraw Hill Publishing Company
9. Stereochemistry Conformation and Mechanism; By P.S. Kalsi, New Age International (P) Ltd. Publisher

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

Sr. No.	CO statement	Marks % weightage
CO-1	Describe the information regarding to the reactive intermediates	20%
CO-2	Classify their properties and their all the possible reaction	20%
CO-3	Calculate stability of organic compound, their character such as aromatic, non- aromatic and anti-aromatic	20%
CO-4	Analyze the knowledge about optical isomer, 3D projection of the compound and their E/Z and R/S nomenclature	10%
CO-5	Compare the stability and structure of various confirmation of organic molecule	20%
CO-6	Develop the important of name reactions which have vast application in industry as well as academic	10%

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- [https://blog.feedspot.com/chemistry\\_websites/](https://blog.feedspot.com/chemistry_websites/)

**Prepared By: Dr. Jyotindra Mahyavanshi**

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**SRICT Institute of Science & Research**

**Master of Science**

**Subject Code: MC3103**

**Subject Name: Physical Chemistry**

**Semester: - I**

**Type of course: Core Course**

**Prerequisite:** Should have knowledge about fundamental laws, physical properties and various physical parameters of molecules

**Rationale:** At the end of the course, Students will have knowledge about various laws of thermodynamics, order of reaction, rate of reaction, solid state chemistry, colloidal and surface chemistry and application related to it.

**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)	
3	0	0	3	70	30	-	-	100

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
<b>1</b>	<b>Chemical kinetics-I:</b> Theories Of Unimolecular gas reaction : Lindeman theory, Kinetics of some complex Reaction (i) Reversible reaction (only first order opposed by first order opposed by first order )(ii) Consecutive reactions (A---B—C); Steady state treatment or approximation, Enzyme catalyzed reactions.	<b>08</b>
<b>2</b>	<b>Chemical kinetics-II:</b> Kinetics of general chain reaction ,Kinetics ,Mechanism, determination of activation energy and chain length of some organic decomposition (i) decomposition of ethane (ii) decomposition of acetaldehyde, Effect of Ionic strength on rates of ionic reaction (Primary and secondary slat effect)Numerical	<b>08</b>
<b>3</b>	<b>Chemical Thermodynamics:</b> Introduction to Laws of Thermodynamics state and path function their applications, thermodynamic description of various types of processes, Maxwell’s relations, Partial molar quantities, Calculation of partial molar quantities, determination of partial molar volume and partial molar enthalpy, Ideal and non-ideal. liquid mixtures	<b>08</b>
<b>SECTION-B</b>		



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<b>4</b>	<b>Solid state chemistry:</b> Bonding in solids and electronic structure in solids, bond theory-metals, semiconductors and insulators, defects in crystals, calculation of schottky and Frenkel defects using statistical method, non-stoichiometry, solid electrolytes, and diffusion in solids, electrical conductivity in solids, super conductivity, and perovskites.	<b>08</b>
<b>5</b>	<b>Surface Chemistry:</b> Adsorption Multilayer Adsorption, the BET adsorption isotherms, derivation of BET equation, determination of surface area and area of cross section of molecules by BET equation. Derivation of Langmuir equation from BET equation. Explanation of different adsorption isotherms, Change in enthalpy, entropy and free energy of adsorption, Adsorption at the surface of liquid: Gibbs adsorption isotherms (derivation). Thermodynamic treatment of adsorption.	<b>10</b>
<b>6</b>	<b>Colloids:</b> Types of colloidal systems, preparation of lyophobic colloidal, Properties of Colloidal systems: (i) electrical properties origin of charges on colloidal, electrical double layer, Zeta potential and its determination by electrophoresis, factor affecting zeta potential, explanation on DLVO theory of colloid stability (ii) Electro kinetic properties: Electrophoresis, electro osmosis.	<b>06</b>

**Suggested Specification table with Marks (Theory):**

<b>Distribution of Theory Marks</b>					
R Level	U Level	A Level	N Level	E Level	C Level
<b>10</b>	<b>15</b>	<b>15</b>	<b>10</b>	<b>10</b>	<b>10</b>

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

**Reference Books:**

1. B.R. Puri, L.R. Sharma, Madan S. Pathania, Principles of physical chemistry, Vishal publishing-Jalandhar.
2. S. Glasstone, Thermodynamics for chemistry.
3. S. Glasstone, An introduction to electrochemistry”, Affiliated East-West press Pvt.Ltd.
4. V.R.Gowarikar, Polymer chemistry, New Age International(P) Ltd, Fifteen,Reprint, Sep.,1999.
5. Introduction to Quantum Chemistry, A. K. Chandra, Tata Mac Graw Hill
6. Quantum Chemistry, Ira N. Levine, Prentice Hall
7. Quantum Chemistry by R. K. Prasad, New Age International Publishers (1985)
8. Physical chemistry by P.W. Atkins ELBs

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**9. Chemical kinetics by K.L.Laidler, Mac Graw-Hill**

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

Sr. No.	CO statement	Marks % weightage
CO-1	Describe the fundamental chapter to determine the rate of reaction, molecularity, order of reaction and decomposition	20%
CO-2	Construct and molar properties and most of the aspect related to the energy and heat.	20%
CO-3	Apply fundamental laws of thermodynamics, theory related to the enthalpy, entropy.	20%
CO-4	Deduce structure of the solid, their properties, their defects and application	10%
CO-5	Explain properties related to surface chemistry	20%
CO-6	Develop approach for application and properties of colloids.	10%

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- [https://blog.feedspot.com/chemistry\\_websites/](https://blog.feedspot.com/chemistry_websites/)

**Prepared By: Dr. Jyotindra Mahyavanshi**

**HOD – Dr. Deepika Shah**

SRICT Institute of Science & Research

Master of Science

Subject Code: MC3104

Subject Name: Analytical chemistry

Semester: - I

Type of course: Core Course

**Prerequisite:** Should have knowledge about various qualitative analysis, its laboratory demonstration, solution calculation, chromatography and its principle

**Rationale:** At the end of the course, Students will have knowledge about various volumetric method of analysis, UV Visible spectroscopy, solution concentration and chromatography and their application.

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)	
3	0	0	3	70	30	-	-	100

Content:

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	<b>Solution and Their Concentration:</b> Molarity, Molality, Normality, ppm, ppb, ppt, %w/v, %w/w, %v/v, Formality, Primary and Secondary standard, Acid Value, Density and Specific Gravity, Numerical.	08
2	<b>Volumetric Method of Analysis:</b> Primary and Secondary standards, Principles of volumetric analysis, Acid–base titration. Titration in non-aqueous solvents, Complex metric titrations, Precipitation titrations (Mohr’s titration, Volhard’s titration, adsorption indicators, Fajan’s titration), Redox titrations, Theoretical aspects of titration curves and end point evaluation, Choice and suitability of indicator in each case.	08
3	<b>UV-Visible Spectrophotometry</b> :Types of electronic transition, auxochrome, chromophore, Bathochromic effect, Hypso chromic effect, Hyper chromic effect, Hypo chromic effect, Factor affecting $\lambda_{max}$ like resonance, hyper conjugation, hydrogen bonding, steric effect , Woodward’s rules for $\alpha,\beta$ unsaturated ketones, Diene systems, aromatic	08

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	system, Effect of solvent on absorption bands, law of absorption with derivation, Elementary idea of double beam automatic recording, Spectrophotometer, Application.	
<b>SECTION-B</b>		
<b>4</b>	<b>Theory of errors:</b> Sources & classification of errors. Statistical treatment of analytical data & presentation of result. Sampling of solids, liquids & gases. Evaluation & validation of analytical methods. Good laboratory practices.	<b>08</b>
<b>5</b>	<b>Chromatography-I:</b> Different chromatographic treatment;1.Coloumn Chromatography: Preparation of column and its applications2.Thin-Layer Chromatography: Selection of stationary and mobile phase, Detection techniques –Elementary idea of HPTLC 3.Gas Chromatography: Selection of mobile phase – Selection of stationary phase in GLC and GSC – Detectors: FID (with modifications), TCD and ECD, Their comparison, Packed column, WCOT,SCOT(advantages and disadvantages)– Temperature programming– Derivatisation in GC – Quantitative Analysis	<b>10</b>
<b>6</b>	<b>Chromatography-II:</b> Liquid Chromatography: Principle of Liquid – Solid chromatography, Comparison with GC, Gradient elution, Displacement chromatography, Principle of HPLC, Instrument and significance of each component, Pumps, Guard column Criteria in selection of mobile phase, Stationary phases (solid, liquid), Bonded phase supports, Detectors: UV absorption, RI detectors – Normal phase and Reversed phase. Method of introducing sample.	<b>06</b>

**Suggested Specification table with Marks (Theory):**

<b>Distribution of Theory Marks</b>					
R Level	U Level	A Level	N Level	E Level	C Level
<b>10</b>	<b>15</b>	<b>15</b>	<b>10</b>	<b>10</b>	<b>10</b>

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

**Reference Books:**

1. “Analytical Chemistry” by Gary D. Christian, 6th Edition, John Wiley and Sons Inc. New Jersey.
2. Lasers: Fundamentals and Applications by K. Thyagarajan, Ajoy Ghatak

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3. Atomic Absorption Spectrometry: Theory, Design, and Applications by Stephen John Haswell
4. Atomic Absorption Spectrometry by Bernhard Welz
5. Packed columns SFC by T.A. Berger, RSC Chromatography Monographs, RSC, 1995.
6. Interpretation of Mass Spectra by Fred W. McLafferty, Turecek University Science Books, 1993.
7. Mass spectrometry-Principles and Applications by Edmond de Hoffmann and Vincent Stroobant, John Wiley and Sons, 2007.

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

Sr. No.	CO statement	Marks % weightage
CO-1	Describe the theory and principal of UV Visible spectra, Instrumentation, application and problem solving	20%
CO-2	Construct basic calculation of solution preparation molarity, normality...Basic knowledge of QC, QA	20%
CO-3	Apply Types of titration, their theories, equation, and calculation.	20%
CO-4	Deduce the Theory, principal and application	10%
CO-5	Explain application in various volumetric experiments.	20%
CO-6	Develop basic and advanced chromatographic techniques	10%

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- [https://blog.feedspot.com/chemistry\\_websites/](https://blog.feedspot.com/chemistry_websites/)

**Prepared By: Dr. Jyotindra Mahyavanshi**

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**SRICT Institute of Science & Research**

**Master of Chemistry**

**Subject Code: MC3105**

**Subject Name: Environment for Chemists**

**Semester: - I**

**Type of course: Open elective (O.E-I)**

**Prerequisite:** A good fundamental backup of basics of Environmental Science for MSC (Chemistry)

**Rationale:** The main objective of this subject is to make students aware about entire Basics of Environmental Science

**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)	
3	0	0	2	70	30	-	-	100

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
<b>1</b>	<b>Introduction to Water &amp; Air Pollutants</b> Water Pollution, Sources of Water Pollution, Classification of Water pollutants, Effects of Water Pollutants, Eutrophication, and Control of Water Pollution. Air Pollution, Sources of Air Pollution, Classification of Air Pollutants, Sources of Air Pollutants and Effects, Control of Air Pollution.	<b>8</b>
<b>2</b>	<b>Land and Noise Pollution</b> Introduction, Land Use, Land Degradation and its causes. Physical, Chemical and Biological Characteristics of Solid Waste. Introduction, Sources of Noise Pollution and its effects.	<b>8</b>
<b>3</b>	<b>Analysis of Air Pollutants and Solid Waste</b> Analysis of PM <sub>2.5</sub> , PM <sub>10</sub> , SO <sub>x</sub> , NO <sub>x</sub> , Proximate and Ultimate Analysis of Solid Waste.	<b>8</b>
<b>SECTION-B</b>		
<b>4</b>	<b>Analysis of Water Parameters</b>	<b>8</b>

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	Turbidity, Color, Chlorine, Fluoride, Hardness, Fluoride, Hardness, Total Dissolved Solids, Total Suspended Solids.	
<b>5</b>	<b>Analysis of Wastewater Parameters</b> Biochemical Oxygen Demand (BOD), Oil & Grease, Chemical Oxygen Demand (COD), Dissolved Oxygen, Residual Chlorine, Ammonical Nitrogen, TOC.	<b>8</b>
<b>6</b>	<b>Environmental Management</b> Introduction to Cleaner Production and its importance, Environmental Impact Assessment, Introduction to Sustainable Development, Introduction to Environmental Audit.	<b>8</b>

**Suggested Specification table with Marks (Theory):**

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
<b>15</b>	<b>15</b>	<b>20</b>	<b>20</b>	<b>0</b>	<b>0</b>

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

**Reference Books:**

1. B.R. Shah, Snehal Popli, “Environmental Studies”, Mahajan Publishing House.
2. Prof. Dr. N.S. Varandani, “Basics of Environmental Studies”, Books India Publication.
3. S.k. Maiti, “Handbook of Methods in Environmental Studies” Centre of Mining Environment, Indian School of Mines, Dhanbad-826 004, India.
4. George Tchobanoglous, “Integrated Solid Waste Management”, Mc Graw Hill, Indian Edition.
5. Guidelines for the measurement of Ambient Air Pollutants, Central Pollution Control Board.
6. Gerard Kiely, “Environmental Engineering” special Indian Edition.

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

Sr. No.	CO statement	Marks % weightage
CO-1	Identify Water Pollutants.	20%
CO-2	Explain Air Pollutants.	20%
CO-3	Develop the concept of Environmental Science.	10%
CO-4	Analyze Environmental Pollutants.	20%
CO-5	Evaluate properties of solid waste.	10%



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CO-6	Create understanding about Environmental Management.	20%
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**List of Open Source Software/learning website:**

- <https://nptel.ac.in/>
- <http://www.iitkgp.ac.in/>

**Prepared By: Dr. Jyotindra Mahyavanshi**

**HOD – Dr. Deepika Shah**



**SRICT Institute of Science & Research**

**Master of Science**

**Subject Code: MC3106**

**Subject Name: Fundamental of Biochemistry**

**Semester: - I**

**Type of course: Open elective (O.E-II)**

**Prerequisite:** Should have basic knowledge of cell, proteins, enzyme and their function.

**Rationale:** At the end of the course students will learn about application of biology in 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)	
3	0	0	3	70	30	-	-	100

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
<b>1</b>	<b>Cell Structure and Functions:</b> Structure of prokaryotic and eukaryotic cells, intracellular organelles and their functions, comparison of plant and animal cells. Overview of metabolic processes catabolism and anabolism. ATP the biological energy currency. Origin of life unique properties of carbon, chemical evolution and rise of living systems. Introduction to biomolecules, building blocks of bio-macromolecules.	<b>08</b>
<b>2</b>	<b>Carbohydrates-I:</b> Conformation of monosaccharides, structure and functions of important derivatives of monosaccharides like glycosides, deoxy sugars, myoinositol, amino sugars. N-acetylmuramic acid, sialic acid, disaccharides and polysaccharides. Structural polysaccharides- cellulose and chitin. Storage polysaccharides starch and glycogen.	<b>08</b>
<b>3</b>	<b>Carbohydrates-II:</b> Structure and biological functions of glucose aminoglycans or mucopolysaccharides. Carbohydrates of glycoproteins and glycolipids. Role of sugars in biological recognition. Blood group substances, Ascorbic acid. Carbohydrate metabolism- Kreb's cycle, glycolysis, glycogenesis and glycogenolysis, gluconeogenesis, pentose phosphate pathway.	<b>08</b>

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<b>SECTION-B</b>		
<b>4</b>	<b>Lipids:</b> Fatty acids, essential fatty acids, structure and function of triacylglycerols, glycerophospholipids, sphingolipids, cholesterol, bile acids, prostaglandins. Lipoproteins - composition and function, role in atherosclerosis. Properties of lipid aggregates-micelles, bilayers, liposomes and their possible biological functions. Biological membranes. Fluid mosaic model of membrane structure. Lipid metabolism - B-oxidation of fatty acids.	<b>08</b>
<b>5</b>	<b>Peptides and Proteins:</b> Chemical and enzymatic hydrolysis of proteins to peptides, Secondary structure of proteins, $\alpha$ - helix, $\beta$ -sheets, super secondary structure, triple helix structure of collagen. Tertiary structure of protein- folding and domain structure, Quaternary structure.	<b>08</b>
<b>6</b>	<b>Amino-acids:</b> Introduction, Classification and types of amino acid, amino acid sequencing. Amino acid metabolism. Degradation and biosynthesis of amino acids, sequence determination: chemical/enzymatic/mass spectral, racemization/detection. Chemistry of oxytocin and tryptophan releasing hormone (TRH)	<b>08</b>

**Suggested Specification table with Marks (Theory):**

<b>Distribution of Theory Marks</b>					
R Level	U Level	A Level	N Level	E Level	C Level
<b>10</b>	<b>15</b>	<b>15</b>	<b>10</b>	<b>10</b>	<b>10</b>

**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 Biochemistry – 7th edition Lehninger, Nelson Cox Macmillan worth Publishers, 2013.
2. Textbook of Biochemistry-West & Todd.4th edition, Macmillan, 1966.
3. Harper's Biochemistry 29th edition, McGraw Hill, 2012.
4. Fundamentals of Biochemistry –.11th edition Agarwal O.P., Goel Publishing House, 2008.
5. Essentials of Biochemistry –2nd edition A.I. Jain. S.Chand publications, 2004.
6. Chemistry of Biomolecules, S. P. Bhutani 2010.
7. Fundamentals of bio chemistry, J.L. Jain, 2005. 8. Introductory Experiments on Biomolecules and their Interactions, Robert K. 2015.

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

Sr. No.	CO statement	Marks % weightage
CO-1	Identify the problems in chemistry based on biology	20%
CO-2	Explain the theories related to the chemistry	20%
CO-3	Develop understanding of mutualism of the subjects	10%
CO-4	Analyze the application of biology in chemistry	20%
CO-5	Evaluate the needs of fundamental biology for chemistry	10%
CO-6	Create approach based on both the subjects	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/](https://blog.feedspot.com/chemistry_websites/)

**Prepared By: Dr. Jyotindra Mahyavanshi**

**HOD – Dr. Deepika Shah**

**SRICT Institute of Science & Research**

**Master of Science**

**Subject Code: MC3107**

**Subject Name: Practicals in Chemistry**

**Semester: - I**

**Type of course: Core Course**

**Prerequisite:** Should have knowledge about basic laboratory safety, use of chemicals, handling of chemicals, use of instruments

**Rationale:** At the end of the course, Students will have knowledge about qualitative and quantitative application. To evaluate physical parameters

**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)	
-	-	18	9	-	-	140	60	200

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	Organic Qualitative Analysis-I	60
2	Inorganic Preparation Practicals	36
3	Physical Chemistry Practicals-I	48
<b>SECTION-B</b>		
4	Organic Qualitative Analysis-II	60
5	Inorganic Qualitative Analysis	54
6	Analytical Chemistry Practicals-I	30

**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)**

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**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.

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

Sr. No.	CO statement	Marks % weightage
CO-1	Describe the various analytical aspects of organic molecules	20%
CO-2	Convert the inorganic materials into useful synthesis	20%
CO-3	Apply the various experimental demonstration	20%
CO-4	Deduce the final structure of molecule	10%
CO-5	Explain the various parameters for inorganic salt determination	20%
CO-6	Compute the various physical and analytical parameters	10%

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- [https://blog.feedspot.com/chemistry\\_websites/](https://blog.feedspot.com/chemistry_websites/)

**Prepared By: Dr. Jyotindra Mahyavanshi**

**HOD – Dr. Deepika Shah**

**SRICT Institute of Science & Research**
**Teaching/Exam Scheme**
**M.Sc. Sem. II**

Sr. No.	Subject Code	Category of course	Course title	Hours Per week		Total con. hrs	Cred its	E	M	I	V	Total Marks
				L	P							
1	MC3108	Core Course	Inorganic Chemistry –II	3	-	3	3	70	30	-	-	100
2	MC3109	Core Course	Organic Chemistry –II	3	-	3	3	70	30	-	-	100
3	MC3110	Core Course	Physical Chemistry-II	3	-	3	3	70	30	-	-	100
4	MC3111	Core Course	Analytical Chemistry – II	3	-	3	3	70	30	-	-	100
5	MC3112	Open Elective-I	Theoretical and Computational Chemistry	3	-	3	3	70	30	-	-	100
6	MC3113	Open Elective-II	Basics of Industrial Chemistry	3	-	3	3	70	30	-	-	100
7	MC3114	Core Course	Practicals in chemistry	-	18	18	9	-	-	60	140	200
			Total	18	18	36	27	420	180	60	140	800

Open Elective -I	1.Environment for Chemists 2. Theoretical and Computational Chemistry
Open Elective -II	1.Fundamental of Biochemistry 2. Basics of Industrial Chemistry

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**Master of Science**

**Subject Code: MC3108**

**Subject Name: Inorganic Chemistry**

**Semester: - II**

**Type of course: Core Course**

**Prerequisite:** Should have knowledge about basic of structure and their properties, reaction mechanism, Wade's rule, metal cluster properties and their application

**Rationale:** At the end of the course, Students will have knowledge about various inorganic reaction mechanism, electronic spectra of metal complexes, metallocarboranes, other higher boranes and their electron calculation

**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)	
3	0	0	3	70	30	-	-	100

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
<b>1</b>	<b>Reaction Mechanism of Transition Metal Complexes-I:</b> Energy profile of a reaction, Reactivity of metal complexes ,inert and labile complexes, kinetic application of valence bond crystal field theories, kinetics of octahedral substitution ,acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, direct and indirect evidences in favor of conjugate mechanism, anation reaction, reaction without metal ligand bond cleavage.	<b>08</b>
<b>2</b>	<b>Reaction Mechanism of Transition Metal Complexes-II:</b> Substitution reaction in Square planar complexes, the trans effect mechanism of the substitution reaction Redox reaction ,electron transfer reaction, mechanism of the one electron transfer reaction, outer sphere type reaction, cross reaction and Marcus -Hush theory, inner sphere type reaction.	<b>08</b>
<b>3</b>	<b>Metal-Ligand Equilibrium in solution:</b> Stepwise and overall formation constants and their interaction, trends in stepwise constants, factors	<b>08</b>

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	affecting the stability of metal complexes with reference to the nature of metal ion and ligand , chelate effect and its thermodynamic origin ,determination of binary formation constants by p H -meter and spectrophotometry.	
<b>SECTION-B</b>		
<b>4</b>	<b>Electronic Spectra and Magnetic Properties of Transition Metal Complexes:</b> Spectroscopic ground states, correlation, Orgel and Tanabe –Sugano Diagrams for transition metal complexes ( $d^{1-9}$ states), calculation of $Dq$ , $B$ and $\beta$ parameters, charge transfer spectra, spectroscopic method of assignment of absolute configuration in optically active metal chelates and their stereo chemical information, anomalous magnetic moments, magnetic exchange coupling and spin crossover.	<b>08</b>
<b>5</b>	<b>Metal Clusters-I:</b> Introduction, Classification, Carbonyl clusters, Low nuclearity carbonyl clusters, High nuclearity carbonyl clusters, Electron counting scheme for HNCCS, Wade's rules., Higher boranes (Hexaborane-10, Decaborane-14) , Number and types of bonds present in higher Boranes.	<b>08</b>
<b>6</b>	<b>Metal Clusters-II:</b> Halides type clusters: Dinuclear clusters, Trinuclear clusters, Tetra nuclear, nuclear clusters, Hexanuclear cluster. Chevrel phases and Zintl Ions, Carboranes, Metalloboranes, Metallocarboranes	<b>08</b>

**Suggested Specification table with Marks (Theory):**

<b>Distribution of Theory Marks</b>					
R Level	U Level	A Level	N Level	E Level	C Level
<b>10</b>	<b>15</b>	<b>15</b>	<b>10</b>	<b>10</b>	<b>10</b>

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

**Reference Books:**

1. 'Kinetic and Mechanism' by A. A. Frost and R. G. Pearson, Wiley, New York, 1953, 1961.
2. Mechanism of Inorganic Reactions by F. Basolo and R. G. Pearson, Second Edition, Wiley Eastern Limited, New Delhi, 1977.
3. Advanced Inorganic Chemistry by F. A. Cotton and R. G. Wilkinson, John Wiley & Sons, N. Y.
4. Principles of Inorganic Chemistry, by Puri. Sharma and Kalia, 33<sup>rd</sup> Edition, Vishal publishing Co. Jalandhar, Delhi, 2017.



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5. Advanced Inorganic Chemistry by S.K.Agarwala and Keemtilal, Pragati Prakashan, Meerut.
6. Advanced Inorganic Chemistry, Volume-II by Gurdeep Raj, Krishna Prakashan Media Ltd., Meerut.
7. Inorganic Chemistry by Gary L. Miessler and Donald A. Tarr, Pearson Education International

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

Sr. No.	CO statement	Marks % weightage
CO-1	Describe the various inorganic reaction mechanism	20%
CO-2	Discuss the reaction condition, metal exchange in octahedral and square planar	20%
CO-3	Discover the stability, its constant in various metal complexes	20%
CO-4	Deduce the various electronic spectra of metal complexes	10%
CO-5	Compare the electronic properties of various metal clusters	20%
CO-6	Explain the electronic rules, structure and properties of metal cluster	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/](https://blog.feedspot.com/chemistry_websites/)

**Prepared By: Dr. Jyotindra Mahyavanshi**

**HOD – Dr. Deepika Shah**

**SRICT Institute of Science & Research**
**Master of Science**
**Subject Code: MC3109**
**Subject Name: Organic Chemistry**
**Semester: - II**
**Type of course: Core Course**

**Prerequisite:** Should have knowledge about reaction and reagents, their application, properties, identification of molecules and stereochemistry

**Rationale:** At the end of the course, Students will have knowledge about various organic substitution and elimination reaction, industrial unit processes, various oxidizing and reducing agents

**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)	
3	0	0	3	70	30	-	-	100

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	<b>Substitution Reactions:</b> (i) Aliphatic Nucleophilic Substitution: The $SN^1$ , $SN^2$ , $SNi$ mechanisms. Reactions of Allylic halides, neighboring group participation by -OH, -NH <sub>2</sub> , -COO <sup>-</sup> , -RS, - halogen, aromatic ring.(ii) Aromatic Nucleophilic Substitution: The $SN^2$ , $SN^1$ and benzyne mechanisms, Reactivity - effect of substrate structure, leaving group and attaching nucleophile, The Von Richter rearrangement, Sommelet-Hauser and Smiles rearrangement. (iii).Elimination reaction: Hoffmann and Zaitsev's rule of elimination, E1, E2 and E1CB Reaction mechanism and orientation.	08
2	<b>Unit process in Chemical Industries-I:</b> (i) Nitration: Nitrating agents. Mechanism of aromatic nitration. Industrial chemicals derived from Benzene, Naphthalene, anthracene using Nitration. (ii)Sulphonation and Sulfation: Sulphonating and Sulfating agents. Mechanism of aromatic Sulphonation. Industrial chemicals derived from Benzene, Naphthalene, and anthracene using Sulphonation.	08
3	<b>Unit process in Chemical Industries-II:</b> (i) Amination: Aminating agents,	08

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	Amination by reduction, Amination by Ammonolysis. Industrial chemicals derived from Benzene using Amination. (ii) Alkylation: Alkylating agents. Industrial important alkyl compounds derived by various rout (iii) Halogenation: Halogenating agents. Industrial important halogenated compounds derived by various routs	
<b>SECTION-B</b>		
<b>4</b>	<b>Reagents in Organic Synthesis [Oxidation] :</b> CrO <sub>3</sub> , MnO <sub>2</sub> , SeO <sub>2</sub> ,Pb(OAc) <sub>4</sub> , OsO <sub>4</sub> , HIO <sub>4</sub> , H <sub>2</sub> O <sub>2</sub> , CH <sub>3</sub> COOAg (Dry & wet),RCOOOH, HgO, NBS, K <sub>3</sub> Fe(CN) <sub>6</sub> ; Some Miscellaneous Reagents in Organic Synthesis : Grignard Reagent and Gilman reagent.	<b>08</b>
<b>5</b>	<b>Reagents in Organic Synthesis [Reduction]:</b> Al(O-iPr) <sub>3</sub> , Zn/HCl, N <sub>2</sub> H <sub>4</sub> /OH,NaBH <sub>4</sub> , LiAlH <sub>4</sub> , Complex Hydrides, Na/NH <sub>3</sub> , Cat.H <sub>2</sub> ,TBTH. Introduction to Green Chemistry, Basic Principles of Green Chemistry; Importance of PTC, ILs, microwave and ultra-sonication in green synthesis.	<b>08</b>
<b>6</b>	<b>Pericyclic reaction:</b> Molecular orbital symmetry, Frontier orbital of ethylene, 1,3-butadiene, 1,3,5-hexatriene and allyl system. Classification of pericyclic reactions. Woodward-Hoffmann correlation diagrams. FMO and PMO approach. Electrocyclic reactions-conrotatory and disrotatory motions, 4n, 4n+2 and allyl systems. Cycloaddition antrafacial and suprafacial addition, 4n, 4n+2 systems, 2+2 addition of ketenes, 1,3 dipolar cycloadditions and cheletropic reactions. Sigmatropic rearrangement – suprafacial and antra facial shifts of H sigmatropic shifts involving carbon moieties, 3,3 and 5,5- sigmatropic rearrangements. Claisen, cope and azacope rearrangement. Fluxional tautomerism. Ene reaction	<b>08</b>

### Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
<b>10</b>	<b>15</b>	<b>15</b>	<b>10</b>	<b>10</b>	<b>10</b>

**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: A Mechanism Approach; Penny Chaloner, CRC Press, Taylor and Francis; Florida.
2. Fine Chemicals: The Industry and Its Business, P. Pollak, 2nd Edition, Wiley

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3. Organic chemistry – J. Clayden, N. Greeves, S. Warren and P. Wothers (Oxford Press)
4. Organic Synthesis, Jagdamba Singh & L.D.S. Yadav, 6th edition, Pragati Prakashan (2010).
5. Advance Organic Chemistry, Reaction Mechanism and Structure by Jerry March, 4th ed. John Wiley & Sons, 1992
6. Pericyclic Reactions, S. M. Mukherji, Macmillan, India
7. Pericyclic Reactions A mechanistic and problem solving approach Sunil Kumar, Vinod Kumar, S.P.Singh Academic Press 2015

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

Sr. No.	CO statement	Marks % weightage
CO-1	Describe the theories, properties and application of various Substitution and Elimination reaction	20%
CO-2	Classify the various Unit processes, their reagents and reaction conditions	20%
CO-3	Apply the Unit processes in Industries.	20%
CO-4	Classify various oxidizing agent and their industrial application	10%
CO-5	Explain various reducing agent and their industrial application	20%
CO-6	Categories various pericyclic reaction, their theories and synthesis.	10%

**List of Open Source Software/learning website:**

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- [https://blog.feedspot.com/chemistry\\_websites/](https://blog.feedspot.com/chemistry_websites/)

**Prepared By: Dr. Jyotindra Mahyavanshi**

**HOD – Dr. Deepika Shah**

**SRICT Institute of Science & Research**

**Master of Science**

**Subject Code: MC3110**

**Subject Name: Physical Chemistry**

**Semester: - II**

**Type of course: Core Course**

**Prerequisite:** Should have knowledge about basics of electronic chemistry, thermodynamics and polymer chemistry

**Rationale:** At the end of the course, Students will have knowledge about theories related to the electro-chemistry, statistical thermodynamics, quantum mechanics, and polymer chemistry

**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)	
3	0	0	3	70	30	-	-	100

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
<b>1</b>	<b>Electronic Structure of Atoms and Molecular Orbital</b> :Theory Electronic configuration, Russell-Saunders terms and coupling schemes, Slater-Condon parameters, term separation energies of the $p^n$ configuration, term separation energies for the $d^n$ configurations, Magnetic effects, spin-orbit coupling. Huckel theory of conjugated Systems, Applications to ethylene, butadiene. Introduction to extended Huckel theory.	<b>08</b>
<b>2</b>	<b>Statistical Thermodynamics-I:</b> Basics of Statistical thermodynamics (Assembly, Canonical ensemble, occupation number statistical weight factor, probability), Thermodynamic probability, Probability and entropy, Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics. Lagrange's methods of multipliers, Partition function.	<b>08</b>
<b>3</b>	<b>Statistical Thermodynamics-I:</b> Thermodynamic properties in term of partition functions(i) Internal energy (ii) Heat Capacity (iii) Third law of thermodynamics(iv) Helmholtz free energy (v) Enthalpy (vi) Gibb's free energy(vii) Chemical potential (viii) Equilibrium constant Molecular partition functions for an ideal gas , Derivation for Translational, Rotational and Vibrational partition functions Numerical.	<b>08</b>

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<b>SECTION-B</b>		
<b>4</b>	<b>Electrochemistry-I:</b> Debye-Huckel theory of strong electrolytes, relaxation effect and electrophoretic effect, Debye Falkenhagen effect, Wein effect. Ionic strength and its determination, Debye-Huckel limiting law. Activity and activity coefficient, determination of activity coefficient by (i) solubility (solubility product principle) (ii) EMF method (cell without transference)	<b>08</b>
<b>5</b>	<b>Electrochemistry-II:</b> Determination of dissociation constant of monobasic acid by conductance method and approximate EMF method, Electrolytic polarization, Dissolution and Decomposition potential, Concentration polarization, Decomposition potential and its determination, Numerical.	<b>10</b>
<b>6</b>	<b>Polymer chemistry:</b> Types of polymers, Stereochemistry of polymers, Kinetics of polymerization (Addition and Condensation), Thermodynamics of polymerization, Phase techniques of polymerization (Bulk, solution, suspension and emulsion), Number & Mass average Molecular mass, Polydispersity Index (P.D.I) Molecular mass determination	<b>06</b>

**Suggested Specification table with Marks (Theory):**

<b>Distribution of Theory Marks</b>					
R Level	U Level	A Level	N Level	E Level	C Level
<b>10</b>	<b>15</b>	<b>15</b>	<b>10</b>	<b>10</b>	<b>10</b>

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

**Reference Books:**

1. B.R. Puri, L.R. Sharma, Madan S. Pathania, Principles of physical chemistry, Vishal publishing-Jalandhar.
2. S. Glasstone, Thermodynamics for chemistry.
3. S. Glasstone, An introduction to electrochemistry", Affiliated East-West press Pvt.Ltd.
4. B.S.Bahl, G.D.Tuli and Arun Bahl, Essential of physical chemistry, S.Chand-New Delhi, Reprint, 2006.
5. V.R. Gowarikar, Polymer chemistry, New Age International(P) Ltd, Fifteen, Reprint, Sep.,1999.
6. Introduction to Quantum Chemistry, A. K. Chandra, Tata Mac Graw Hill
7. Physical chemistry by P.W. Atkins ELBs
8. Chemical kinetics by K.L.Laidler, Mac Graw-Hill

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

Sr. No.	CO statement	Marks % weightage
CO-1	Describe the quantum mechanics properties of the molecule.	20%
CO-2	Construct basic and fundamental of metal $\pi$ complexes, its structure, bonding, synthesis and properties.	20%
CO-3	Apply statistical methods of thermodynamics chemistry.	20%
CO-4	Deduce energy, enthalpy and chemical potential.	10%
CO-5	Explain theories related to the electrochemistry.	20%
CO-6	Develop approach for evaluating properties and design methods.	10%

**List of Open Source Software/learning website:**

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- [https://blog.feedspot.com/chemistry\\_websites/](https://blog.feedspot.com/chemistry_websites/)

**Prepared By: Dr. Jyotindra Mahyavanshi**

**HOD – Dr. Deepika Shah**

**SRICT Institute of Science & Research**
**Master of Science**
**Subject Code: MC3111**
**Subject Name: Analytical Chemistry**
**Semester: - II**
**Type of course: Core Course**
**Prerequisite:** Should have knowledge about basics of molecular spectroscopy

**Rationale:** At the end of the course, Students will have knowledge about IR, NMR and MASS Spectroscopy and structure elucidation on basis of it

**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)	
3	0	0	3	70	30	-	-	100

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	<b>IR Spectrophotometry:</b> IR Spectroscopy: Introduction: Theory, Instrumentation: single beam, double beam spectrophotometers, radiation sources, sample cells, monochromators, detectors, sample handling, Resolution, wave number measurement, Useful terms: IR region, types of vibrations: fundamental and overtones, linear and nonlinear molecule, equation for vibrational frequency, selection rule, coupling interactions, hydrogen bonding information, Fermi resonance. IR spectra: group frequency, group frequency region, finger print region, spectra interpretations (Amino, carboxyls, hydroxyl, ethers groups containing compounds) and structure elucidation. FTIR: principle, instrument design, and function of beam splitter, Advantages of FTIR vs. IR. Structure elucidation based on IR	09
2	<b>NMR Spectroscopy-I</b> :Theory and principles of NMR spectroscopy, Theory of Fourier Transform 1H NMR Spectroscopy Proton resonance condition, Aspects of PMR spectra – number of signals, chemical shift, factors influencing chemical shift, deshielding, chemical shift values and correlation for protons bonded to carbons (aliphatic, olefinic, aldehydic, aromatic) and other nuclei (alcohols, phenols, enols, acids, amides and mercaptans), effect of deuteration, spin-spin coupling, (n+1) rule, factors	09



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	effecting coupling constant “J” Structure elucidation based on NMR	
<b>3</b>	<b>Thermogravimetry:</b> Thermogravimetric, Instruments for TGA- thermos balance and furnace, Calibration of temperature scale, Factor affecting TGA results instrumental and experimental, Applications.	<b>06</b>
<b>SECTION-B</b>		
<b>4</b>	<b>NMR Spectroscopy-II:</b> (i) <sup>13</sup> C NMR spectroscopy Types of <sup>13</sup> C NMR Spectra: proton coupled and decoupled <sup>13</sup> C spectra, chemical shift, calculations of chemical shifts of aliphatic, olefinic, alkyne, aromatic, hetero aromatic and carbonyl carbons, factors affecting chemical shifts (ii) 2D NMR Techniques Preliminary idea of 2D NMR Structure elucidation based on NMR	<b>08</b>
<b>5</b>	<b>MASS Spectrometry:</b> Theory and principles of mass spectroscopy; Instrumentation; low and high resolution mass spectra; Ionization techniques – Electron Impact (EI) ionization, Chemical Ionization (CI), Field Desorption (FD), Fast Atom Bombardment (FAB), Electron spray ionization (ESI); Determination of molecular weight and molecular formula, nitrogen rule, detection of molecular ion peak, metastable ion peak; Fragmentations – rules governing the fragmentations, McLafferty rearrangement; Interpretation of mass spectra of different class of compounds – saturated and unsaturated hydrocarbons, aromatic hydrocarbons, alcohols, ethers, ketones, aldehydes, carboxylic acids, amines, amides, compounds containing halogens; To write possible fragmentation for given compound; To identify structure from mass spectral data; To identify structure from combined spectral data. Structure elucidation by using UV, IR, NMR and Mass Spectroscopic techniques. Structure elucidation based on MASS	<b>10</b>
<b>6</b>	<b>Thermometric titration:</b> Thermometric Titration (TT), Advantages, Instrument, Applications of TT in Neutralization Titration, Precipitation Titration, Complexometry Titration and Redox titration.	<b>06</b>

**Suggested Specification table with Marks (Theory):**

<b>Distribution of Theory Marks</b>					
R Level	U Level	A Level	N Level	E Level	C Level
<b>10</b>	<b>15</b>	<b>15</b>	<b>10</b>	<b>10</b>	<b>10</b>

## SRICT Institute of Science & Research

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

### Reference Books:

1. R.M. Silverstein and F.X. Webster, Spectroscopic Identification of Organic Compounds, 6th Edition (2003) John Wiley, New York.
2. Introduction to Spectroscopy, D. L. Pavia, G. M. Lampman and G. S. Kriz, 3rd edition (Thomson Brooks/Cole)
3. Organic Spectroscopy, William Kemp, 3rd edition (Palgrave)
4. Spectroscopy of Organic Compounds, P. S. Kalsi, 5th edition (New Age International Publishers)
5. Elementary Organic Spectroscopy: Principles and Chemical applications (revised edition), Y. R. Sharma (S. Chand Publishing)
6. Analytical Chemistry: Principles and Techniques: Larry G. Hargis (Prentice-Hall International edition)
7. Treatise on Analytical Chemistry: I. M. Kohthoff & P. J. Elving (John Wiley & Sons, New York).
8. Handbook of Analytical Chemistry: L. Meites (McGraw-Hill, New York).

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

Sr. No.	CO statement	Marks % weightage
CO-1	Describe theory and principal of IR spectra, Instrumentation, application	20%
CO-2	Discuss the various theory of NMR Spectroscopy and their principle	20%
CO-3	Apply the application of thermogravimetry to various materials	20%
CO-4	Deduce the application of NMR Spectroscopy to various organic molecules	10%
CO-5	Evaluate the various theories related to the MASS Spectroscopy	20%
CO-6	Develop the application of thermometric titration	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/](https://blog.feedspot.com/chemistry_websites/)

**Prepared By: Dr. Jyotindra Mahyavanshi**

**HOD – Dr. Deepika Shah**

**SRICT Institute of Science & Research**

**Master of Science**

**Subject Code: MC3112**

**Subject Name: Theoretical and computational Chemistry**

**Semester: - II**

**Type of course: Open elective (O.E-I)**

**Prerequisite:** Should have a knowledge about basics computer, operating systems various applications.

**Rationale:** At the end of the course, Students have knowledge about that students learns the basic of UNIX and LINUX programming. Students learn about molecular mechanics and how it is implemented into 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)	
3	0	0	3	70	30	-	-	100

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
<b>1</b>	<b>Introduction:</b> Introduction to the LINUX and UNIX operating system, LINUX/UNIX commands, Difference in UNIX and LINUX operating systems, Comparison of LINUX operating system with windows	<b>08</b>
<b>2</b>	<b>Electronic Structure Theory-I:</b> Molecular mechanics: Introduction, Basic theory, Concept of potential energy surface. Force field and its components (stretch- Morse Potential, bend, out-of-plane bending, torsional, van der Waals and electrostatic energy). Electronic structure methods: Basics of electronic structure calculations, Semi-empirical methods and Ab-initio methods, Advantages of Semi-empirical methods.	<b>08</b>
<b>3</b>	<b>Electronic Structure Theory-II:</b> Electronic structure methods: Basics of electronic structure calculations, Semi-empirical methods and Ab-initio methods, Advantages of Semi-empirical methods.	<b>08</b>
<b>SECTION-B</b>		
<b>4</b>	<b>Electronic Structure Theory-III:</b> Density functional methods: Basic theory, building geometry, Basis set, functional's, Notation, Level of theory, Optimization and computable properties like absorption, energy,	<b>08</b>

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	optimized bond lengths, bond angles, dihedral angles, charge calculations.	
<b>5</b>	<b>Cheminformatics in Drug Design-I:</b> Computer-aided drug discovery: Classification of CADD, Ligand-based drug design, Structure-based drug design, Virtual screening. Ligand based drug design: Basic concept, Pharmacophore modelling and QSAR (brief overview).	<b>10</b>
<b>6</b>	<b>Cheminformatics in Drug Design-II:</b> Common softwares for implementing ligand-based drug design. Structure-based drug design: Basic concept, Pharmacophore modelling and Molecular docking (brief overview), common softwares for implementing structure-based drug design.	<b>06</b>

**Suggested Specification table with Marks (Theory):**

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
<b>10</b>	<b>15</b>	<b>15</b>	<b>10</b>	<b>10</b>	<b>10</b>

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

**Reference Books:**

- Linux Fundamentals by Paul Cobbault, Publication
- Online tutorial pdf: [https://www.tutorialspoint.com/unix/unix\\_tutorial.pdf](https://www.tutorialspoint.com/unix/unix_tutorial.pdf) (UNIX computer operating system by tutorial points)
- Computational Chemistry: A Practical Guide for Applying Techniques to Real-World Problems. David C. Young Copyright (2001 John Wiley & Sons, Inc.)
- Exploring Chemistry with electronic structure methods, 2nd edition, James V. Foreman.
- Cheminformatics in Drug Discovery: Methods and Principles in Medicinal Chemistry, Vol. 23, edited by Tudor I. Opera.
- Computational Drug Design: A Guide for Computational and Medicinal Chemists, By D. C. Young.
- The Practice of Medicinal Chemistry, 4th edition, edited by Camille Georges Wermuth, David Aldous Pierre Robison Didier Rognan.

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

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the types of operating systems	20%
CO-2	Explain the concept of molecular mechanics and its implementation	20%

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CO-3	Describe the role of electronic structure calculations in defining the experimental research.	20%
CO-4	Explain the role of CADD in drug discovery process.	10%
CO-5	Describe the use of different computational softwares.	20%
CO-6	Utilize the softwares to evaluate the structural parameters related to small organic 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/](https://blog.feedspot.com/chemistry_websites/)

**Prepared By: Dr. Jyotindra Mahyavanshi**

**HOD – Dr. Deepika Shah**

## SRICT Institute of Science & Research

**Master of Science**

**Subject Code: MC3113**

**Subject Name: Basics of Industrial Chemistry**

**Semester: - II**

**Type of course: Open elective (O.E-II)**

**Prerequisite:** To have a knowledge about basics unit process and unit operation. Some fundamental aspects of chemical Industries.

**Rationale:** At the end of the course, students will have knowledge about the principles and practice of chemical industries and can observe, analyze and interpret chemical phenomena and process.

**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)	
3	-	-	3	70	30	-	-	100

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
<b>1</b>	<b>Regulatory aspects-I</b> Concept of ISO, Total quality management(TQM), Six sigma, Kaizen, 5S, JIT, Total quality control (TQC), Total waste elimination(TWE), Total productive maintenance(TPM).	<b>08</b>
<b>2</b>	<b>Regulatory aspects-II</b> Concepts and guidelines of USFDA, Good laboratory practices (GLP), Good manufacturing practices (GMP), GPC, ICH guidelines, research methodology used in CRO.	<b>08</b>
<b>3</b>	<b>Regulatory aspects-III</b> Government standards like ISI, MINAS, Agmark, I. P., D. P., U.S. P., concepts of quality and quality control, the nature of variability, preparation of control charts, charts for moving averages, defects and defectives. Specification and tolerances, sampling inspection, cost reduction and quality improvement experiments.	<b>08</b>
<b>SECTION-B</b>		

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<b>4</b>	<b>Material of constructions:</b> Mechanical properties, Corrosion resistance. Plastics, Ceramics. Metals and alloys, Stainless steel, Special material for food and pharmaceutical equipment. Protective coatings, Surface treatment to metals for corrosion resistance.	<b>08</b>
<b>5</b>	<b>Industrial Instrumentation:</b> Measurement of temperature, Thermo couples and pyrometers, High temperature thermometers, Optical pyrometers. Measurement of pressure and vacuum, Manometric and Bourdon gauges, Vacuum gauges, Ionization and pirani gauges. Flow measurement, Pitot tube, Rotameters, Liquid level indicators. Hook Type, Sight glass, Float type, Capacitance level indicator, Radiation level indicator.	<b>08</b>
<b>6</b>	<b>Design of Vessels:</b> Classification of chemical reactors, pressure vessels for internal or external pressure, Maintenance, Storage vessels for liquids and gases. Design of chemical reactors, Reactors with chemical addition, agitation, heating, removal of vapors, gas addition.	<b>08</b>

### Suggested Specification table with Marks (Theory):

Distribution of Theory Marks					
R Level	U Level	A Level	N Level	E Level	C Level
<b>10</b>	<b>15</b>	<b>15</b>	<b>10</b>	<b>10</b>	<b>10</b>

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

### Reference Books:

1. F. A. Henglein; Chemical technology (Pergamon)
2. J. M. Coulson, J. F. Richardson: Chemical Engineering, Vol. I, II, III (Pergamon)
3. R. N. Shreve: The Chemical Process Industries (MGH)
4. W. I. Badger and J. T. Bandchero: Introduction to Chemical Engineering (MGH)
5. O. A. Hougen, R. M. Watson and R. A. Ragetz: Chemical Process Principles (Vol. I, II (JW))
6. P. H. Grogins: Unit processes in organic synthesis (MGH)
7. A. A. Frost and R. G. Pearson: Kinetics and Mechanism
8. P. W. Atkins and Julio de Paule: Physical Chemistry, VII<sup>th</sup> Edn. (Ostord Union press, 2002)
9. S. Glasstone: Textbook of Physical Chemistry, II<sup>nd</sup> Edn. (McMillan India LTD. 1996)
10. W. J. Moore: Physical Chemistry, X<sup>th</sup> Edn (Orient Longmans, 1993)
11. Thermodynamics, A core course, by R. C. Srivastava, S. K. Saha, A. K. Jain Prentice Hall of India Pvt. Ltd, 2004.

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

Sr. No.	CO statement	Marks % weightage
CO-1	Understand the types of regulatory aspects	20%
CO-2	Explain the concept of various regulation on side.	20%
CO-3	Describe the role of various rules and their effectiveness.	20%
CO-4	Explain the role of different material for constructions.	10%
CO-5	Describe the use of various vessels in chemical industries.	20%
CO-6	Utilize the instrumentation for measuring on process and off process parameters.	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/](https://blog.feedspot.com/chemistry_websites/)

**Prepared By: Dr. Jyotindra Mahyavanshi**

**HOD – Dr. Deepika Shah**



**SRICT Institute of Science & Research**

**Master of Science**

**Subject Code: MC3114**

**Subject Name: Practicals in Chemistry**

**Semester: - II**

**Type of course: Core Course**

**Prerequisite:** Should have knowledge about basic laboratory safety, use of chemicals, handling of chemicals, use of instruments

**Rationale:** At the end of the course, Students will have knowledge about qualitative and quantitative application. To evaluate physical parameters.

**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)	
-	-	18	9	-	-	140	60	200

**Content:**

Sr. No.	Content	Total Hrs.
<b>SECTION-A</b>		
1	Organic Preparation	60
2	Inorganic Estimation	36
3	Physical Chemistry Practical-II	48
<b>SECTION-B</b>		
4	Organic Estimation	60
5	Inorganic Gravimetric analysis	54
6	Analytical Chemistry Practical-II	30

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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. 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.

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

Sr. No.	CO statement	Marks % weightage
CO-1	Describe the various analytical aspects of organic molecules	20%
CO-2	Convert the inorganic materials into useful synthesis	20%
CO-3	Apply the various experimental demonstration	20%
CO-4	Deduce the final structure of molecule	10%
CO-5	Explain the various parameters for inorganic salt determination	20%
CO-6	Compute the various physical and analytical parameters	10%

#### List of Open Source Software/learning website:

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- [https://blog.feedspot.com/chemistry\\_websites/](https://blog.feedspot.com/chemistry_websites/)

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