

**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	Credits	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	MC3105/ MC3112/ MC3115	Open Elective-I	-	3	-	3	3	70	30	-	-	100
6	MC3106/ MC3113/ MC3116	Open Elective-II	-	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- MC3105 2.Theoretical and Computational Chemistry- MC3112 3. Chemistry of Dyes and Dye Intermediates - MC3115
Open Elective -II	1.Fundamental of Biochemistry- MC3106 2. Basics of Industrial Chemistry- MC3113 3. Chemicals of Industrial important - MC3116

**SRICT Institute of Science & Research**
**Master of Science**
**Subject Code: MC3108**
**Subject Name: Inorganic Chemistry-II**
**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>		
1	<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.	08
2	<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.	08
3	<b>METAL-LIGAND EQUILIBRIUM IN SOLUTION:</b> Stepwise and overall formation constants and their interaction, trends in stepwise constants, factors affecting the stability of metal complexes with	08

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	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.
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.

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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/)

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**HOD – DR. DEEPIKA SHAH**

**SRICT Institute of Science & Research**
**Master of Science**
**Subject Code: MC3109**
**Subject Name: Organic Chemistry-II**
**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 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>SUBSTITUTION REACTIONS:</b> (i) Aliphatic Nucleophilic Substitution: The SN <sup>1</sup> , SN <sup>2</sup> , 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 <sup>2</sup> , SN <sup>1</sup> 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, Amination by reduction, Amination by Ammonolysis. Industrial chemicals derived from Benzene using Amination. (ii)	08

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	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):**

<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. Organic Chemistry: A Mechanism Approach; Penny Chaloner, CRC Press, Tailor and Francis; Florida.
2. Fine Chemicals: The Industry and Its Business, P. Pollak, 2nd Edition, Wiley
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).

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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%

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**SRICT Institute of Science & Research**

**Master of Science**

**Subject Code: MC3110**

**Subject Name: Physical Chemistry-II**

**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 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>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>
<b>SECTION-B</b>		



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<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):**

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. 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

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

Sr. No.	CO statement	Marks % weightage
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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%

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**SRICT Institute of Science & Research**

**Master of Science**

**Subject Code: MC3111**

**Subject Name: Analytical Chemistry-II**

**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	<b>09</b>
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 effecting coupling constant “J” Structure elucidation	<b>09</b>

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	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>

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

**Reference Books:**

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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. Kolthoff & 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%

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**SRICT Institute of Science & Research**

**Master of Chemistry**

**Subject Code: MC3105**

**Subject Name: Environment for Chemists**

**Semester: - I/II**

**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> Turbidity, Color, Chlorine, Fluoride, Hardness, Fluoride, Hardness, Total Dissolved Solids, Total Suspended Solids.	<b>8</b>
<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>

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<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>
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**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>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%
CO-6	Create understanding about Environmental Management.	20%

**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: MC3112**
**SUBJECT NAME: THEORETICAL AND COMPUTATIONAL CHEMISTRY**
**SEMESTER: - I/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>		
1	<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	08
2	<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.	08
3	<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.	08
<b>SECTION-B</b>		
4	<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	08



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	absorption, energy, 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:**

1. Linux Fundamentals by Paul Cobbault, Publication
2. 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)
3. Computational Chemistry: A Practical Guide for Applying Techniques to Real-World Problems. David C. Young Copyright (2001 John Wiley & Sons, Inc.)
4. Exploring Chemistry with electronic structure methods, 2nd edition, James V. Foreman.
5. Cheminformatics in Drug Discovery: Methods and Principles in Medicinal Chemistry, Vol. 23, edited by Tudor I. Opera.
6. Computational Drug Design: A Guide for Computational and Medicinal Chemists, By D. C. Young.
7. 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%
CO-3	Describe the role of electronic structure calculations in defining the experimental research.	20%

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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: MC3115**
**Subject Name: Chemistry of Dyes and Dye Intermediates**
**Semester-I/II**
**Type of course: Open Elective –I (O.E.-I)**

**Prerequisite:** Should have basic knowledge about fundamental principles of organic dyes and their applications

**Rationale:** At the end of the course, students will have knowledge about synthesis, theories and application of various dyes. And various dying process according to fabric and dyeing industries

**Teaching and Examination Scheme:**

Teaching Scheme			Credits	Examination Marks				Total Marks
L	T	P	C	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>BASIC CONCEPTS OF DYE AND DYE INTERMEDIATES-</b> Introduction of Dyes and Pigments, Absorption of visible light, colour of wavelength absorbed, complementary colour. Relation between color and chemical Constitution, Witt's theory, Armstrong's theory, Nietzki's theory, Valence bond theory, Molecular orbital theory, Fastness Properties, Exhaustion and fixation properties. Natural Dyes, Nomenclature of Dye Intermediates, Colour Index	08
2	<b>STUDIES OF SOME INDUSTRIAL DYES-I:</b> General nature, classification, structural variation, synthesis and application of fibres of the following classes of dyes: (i)Reactive dyes (ii)Triphenylmethane dyes (TPM) (iii)Acid dyes  Synthesis of only the following: Procion Brilliant Blue MR, Procion Brilliant Red H-3B, Remazol Brilliant Blue R, Malachite Green, Crystal Violet, Acid Yellow 73, Acid Red 1, Acid Black 24	08
3	<b>AZO DYES:</b> General Introduction: Diazotization, mechanism and different methods of diazotization and laws of coupling  Synthesis of the following: Disperse Red 13, Acid Blue 92, Mordant Black 3, Acid Black 1, Acid Blue 113, Direct Blue 15, Direct Violet 1,	08

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	Direct Red 28, Naphthol AS-BR, Fast Orange GGD.	
<b>SECTION-B</b>		
<b>4</b>	<b>ANTHRAQUINONE DYES</b> : Vat Dyes and Solubilized Vat dyes, Acid dyes, Mordant dyes and dyes for cellulose acetate. Synthesis of only the following: Indanthrene Orange 7RK, Indanthrene Yellow FFRK, Indanthrene Khakhi 2G, Indanthrene Orange FFRK, Indanthrene Yellow 4GK, Indanthrene Scarlet B, Caledon Jade Green XBN, Anthracene Blue SWX, Indanthrene Brilliant Orange GR, Celliton Fast Blue FFG.	<b>08</b>
<b>5</b>	<b>STUDIES OF SOME INDUSTRIAL DYES-II:</b> General nature, classification, structural variation, synthesis and application of fibres of the following classes of dyes: (i)Disperse dyes (ii)Indigoid and Thio-indigoid dyes (iii)Cationic dyes  Synthesis of the following: Disperse Yellow 16, Disperse Blue 14, Celliton Fast Yellow 7G, Ciba Blue 2B, Indanthrene Brilliant Pink R, Bismarck Brown, Chrysoidine Y, Methylene Blue, Acridine Yellow G, Disperse Orange 29	<b>08</b>
<b>6</b>	<b>BASIC OPERATIONS IN DYEING PROCESS:</b> Preparation of the fibres, Preparation of the dyebath, application of the dyebath and finishings, Various methods of dyeing: Direct dyeing, Vat dyeing, Mordant dyeing, Disperse dyeing and Formation of dye on the fibre, Dyeing of wool with the acid dyes, Dyeing with the reactive dyes, Fastness properties: Colour fastness, Light fastness, Sublimation fastness and Burnt gas fumes fastness.	<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. The chemistry of synthetic Dyes, Vol. I to VII by Venkataraman, Academic Press, New York.
2. Chemistry of Synthetic Dyes & Pigments by Lubs.
3. Dyes and their intermediates by E. N. Abrahart.
4. Handbook of synthetic dyes and pigments, Vol. I & II by K. M. Shah.
5. Industrial Dyes by Klans Hunger, Germany by Wiley-VCH.
6. Development in the Chemistry and technology of Organic Dyes by J.Griffiths, Blackwell Sci. Pub., Oxford, London.

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7. Principles of colour Technology by Fred W. Billmeyer and Max Saltzman, John Wiley & Sons.
8. Advance in colour chemistry, series vol.-3, and Modern colorants: Synthesis and structure, edited by A.T.Peters and H.S. Freeman, Blackie Academic & Professional (1995).
9. Colour chemistry: Synthesis, properties and applications of organic dyes and pigments, Heinrich Zollinger VCH, Germany(1987).
10. Organic Chemistry in Colour V., P.F.Gordan, P. Gregory, Spinger-Verlag(1983).
11. Textile Auxiliaries, J.W. Batty Chemical applications of group theory by F. A. Cotton (Second edition), Wiley Eastern Limited, 1976 New Delhi.
12. Chemistry of Dyes and Principles of dyeing-V.A. Shenai
13. Synthetic dyes- G.R. Chatwal

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

Sr. No.	CO statement	Marks % weightage
CO-1	Recollect the various fundamental theories of color and constitution	20%
CO-2	Classify the dyes based on their uses and structure	20%
CO-3	Examine the azo dyes for their synthesis and application	20%
CO-4	Determine the dyeing process and dyeing operation for fabric	10%
CO-5	Explain the synthetic applications of various set of dyes	20%
CO-6	Prepare the synthesis of dyes of different classes	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: MC3106**

**Subject Name: Fundamental of Biochemistry**

**Semester: - I/II**

**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	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	<b>08</b>

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	phosphate pathway.	
<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: MC3113

Subject Name: Basics of Industrial Chemistry

Semester: - I/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>		
1	<b>REGULATORY ASPECTS:</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).	08
2	<b>GUIDELINES FOR GOOD PRACTICES:</b> Concepts and guidelines of USFDA, Good laboratory practices (GLP), Good manufacturing practices (GMP), GPC, ICH guidelines, research methodology used in CRO.	08
3	<b>PERAMETERS FOR QUALITY CONTROLS:</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.	08
<b>SECTION-B</b>		
4	<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.	08

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<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):**

<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. 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)

**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%

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**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: MC3116**

**Subject Name: Chemicals of Industrial important  
Semester I/II**

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

**Prerequisite:** To have knowledge about basic industrial synthesis, unit process and operation and reagents.

**Rationale:** At the end of the course, students will have knowledge about various important industrial chemicals their commercial 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>		
<b>1</b>	<b>PHARMACEUTICALS INTERMEDIATES:</b> The method for the large scale production with flow diagram and uses of: (i)Acetoacetanilide (ii) Anthraquinone (iii) $\beta$ -naphthol from naphthalene (iv) Bon acid (v) Aspirin (vi) Chloramphenicol (vii) Paracetamol (viii) p-Amino phenol (ix) Saccharin (x) 2,4-D acid .	<b>08</b>
<b>2</b>	<b>AGROCHEMICALS:</b> Introduction, Definition insecticides, classification of insecticides on basis of mode of action. Synthesis of Methoxychlor, Captan, Parathion, Malathion and Perthane. Inorganic insecticides, Natural and synthetic insecticides, organic insecticides, Eldrin, Dieldrin, BHC, Tetra ethyl pyrophosphate (TEPP), Introduction of Fungicides like Bordeaux mixture, Dithio carbamates, Baygon , Termik, Zineb	<b>08</b>
<b>3</b>	<b>SYNTHESIS OF IMORTANT SOLVENTS:</b> Industrial manufacturing process with flow diagram & their uses. (1) Preparation of methanol from synthesis gas. (2) Preparation of Isopropanol from propylene. (3) Preparation of acetone from isopropanol. (4) Preparation of formaldehyde from methanol by oxidation dehydration process. (5) Acetylene from natural gas.	<b>08</b>
<b>SECTION-B</b>		

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<b>4</b>	<b>PETROCHEMICALS:</b> General account of petrochemicals used as monomers in the manufacture of polyester fibers, manufacture of DMT, Terphthalic acid, Phthalic anhydride, Maleic anhydride, 1:4 Butanediol and other monomers like Penta erithritol and Di-isocyanates.	<b>08</b>
<b>5</b>	<b>SYNTHESIS OF SOME IMPORTANT AROMATICS:</b> Manufacture and industrial applications of benzene, toluene, xylene, naphthalene, phenol, styrene, aniline, maleic anhydride.	<b>10</b>
<b>6</b>	<b>POLYMERS:</b> Manufacture and industrial applications of chemicals obtained from Propylene: Iso propyl alcohol, Acetone (Wacker-Chemie process), Propylene oxide (Halcon process), Acrylonitrile, Glycerol and Isoprene, Propylene tetramer, Acrylic acid, nButyraldehyde (Oxo process), Methyl isobutyl ketone, Acrolein, Acrylamide, Methyl methacrylate	<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. Billmeyer, F.W., Jr., Text Book of Polymer Science, 3 ed New York: Wiley 1984.
2. Elias, Hans-Georg, An Introduction to Polymer Science, Weinheim: VCH, 1997
3. Hiemenz, P.C. Polymer Chemistry, New York: Dekker, 1984
4. Seymour, R.B., and C.E. Carraher., Jr., Polymer Chemistry- An Introduction, 3rd ed. New York, Dekker, 1992
5. Stevens, M.P., Polymer Chemistry, 2nd ed. New York: Oxford Univ. Press, 1990.
6. Odian, G., Principles of Polymerization, 3d ed., New York: Wiley 1992
7. Braun, D., Simple Methods for Identification of Plastics, 2d ed., Cincinnati, Ohio: Hanser-Gardner, 1986
8. Woodward, A.E., Understanding Polymer Morphology, Munich: Hanser, 1995
9. Tanford, C., Physical Chemistry of Macromolecules, New York: WileyInterscience, 1961

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

Sr. No.	CO statement	Marks % weightage
CO-1	Gain knowledge about the important chemicals.	20%
CO-2	Understand the basics of industrially important chemicals.	20%
CO-3	Analyze the application of chemicals.	20%

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CO-4	Apply how to evaluate a reaction or process for better production	10%
CO-5	Focus on the newer route of the synthesis.	20%
CO-6	Evaluate the more application and useful products from the existing one.	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 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 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

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

<b>Distribution of Theory Marks</b>					
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)**

## SRICT Institute of Science &amp; Research

**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:**

- <https://www.library.qmul.ac.uk/subject-guides/chemistry/useful-websites/>
- [https://blog.feedspot.com/chemistry\\_websites/](https://blog.feedspot.com/chemistry_websites/)

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