UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for
Postgraduate Degree Courses in MSc -Chemistry

Outcome Based Curriculum

Programme : Master of Science (CHEMISTRY)

Vision of the Departments :

A respectable teaching – learning and research organization nationally and internationally in the area of chemical sciences. By providing competitive trained chemists which will assist the chemical world, industries and stake holders The mission and vision of the organization help in preparation of strategic plan.

Mission of the Departments:

To develop the researcher and scientist in chemical science through post-graduate education and research programme.

To develop the competent manpower with technology based experimentation

methodologies and value based practices for business and industries.

To undertake projects to solve field base problems.

To provide student centric learning facilities for the development of overall personality of learner.

Programme Educational Objectives:

The program educational objectives (PEO) are the statement that describes the career and professional achievement after the program of studies (graduation/ post-graduation). The PEO s are driven form question no. (ii) of the Mission statement (What is the purpose of organization). The PEOs can be minimum three and maximum five.

PEO1: To have advance knowledge of chemistry domain.
PEO2: To provide the professional services to industry, Research organization, institutes.
PEO3: To provide the professional consultancy and research support for the relevant organization in the domain of super specialization.

PEO4: To opt for higher education, disciplinary & multi-disciplinary research and to be a life-long learner.
PEO5: To provide, value based and ethical leadership in the professional and social life.

Program Outcomes:

The program outcomes (PO) are the statement of competencies/ abilities. POs are the statement that describes the knowledge and the abilities the post-graduate will have by the end of program studies.

PO1: In-depth and detailed functional knowledge of the fundamental theoretical concepts and experimental methods of chemistry.
PO2: Apply/implement interface between on the one hand, the history of chemistry and natural science and, on the other hand, issues pertaining to the areas of modern technology, health, and environment.
PO3: Skills in planning and conducting advanced chemical experiments and applying structural-chemical characterization techniques.
PO4: Skill in examining specific phenomena theoretically and/or experimentally.
PO5: Generation of new scientific insights or to the innovation of new applications of chemical research.

Course- Program outcome Matrix:

The Program Outcomes are developed through the curriculum (curricular/co-curricular extra-curricular activities). The program outcomes are attained through the course implementation. As an educator, one must know, "to which POs his/her course in contributing?". So that one can design the learning experiences, select teaching method and design the tool for assessment. Hence, establishing the Corse-PO matrix is essential step in the OBE. The course-program outcomes matrix indicates the co-relation between the courses and program outcomes. The CO-PO matrix is the map of list of courses contributing to the development of respective POs

PROGRAM SPECIFIC OUTCOMES (PSOs) OF THE PROGRAMME

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(06) Programme PO's and PSO's Mapping

			PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9		
S. No	**Program**	**Courses Category**	Problem Analysis	Design/Development of Solution	Investigation	Modern Tool Usage	Environment and Sustainability	Ethics	Individual and Team Work	Project Management	Life-Long Learning	**PSO 1**	**PSO 2**
1	**MSc Chemistry**	Humanities and Social Sciences including Management courses	*			*		*			*	*	
2		Basic Science courses	*	*	*	*	*						*
3		Engineering Science courses including workshop, drawing, basics of electrical/mechanical/computer etc.											
4		Professional core courses	*	*	*							*	
5		Professional Elective courses relevant to chosen specialization/branch	*	*	*	*		*	*				*

6		Open subjects – Electives from other technical and /or emerging *subjects	*	*	*	*	*	*	*		*	*	*
7		Project work, seminar and internship in industry or elsewhere	*	*	*		*	*	*	*	*		*
8		Specific core subject	*	*	*								
9		Mandatory Course (Non credit)					*	*	*		*		

(07) Semester wise PO's and SPO's Mapping

Sem	Name of the Courses/POs /Basic,	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PSO 1	PSO 2
	Core Electives, Projects, Internships etc.)	**Problem Analysis**	**Design/Development of Solution**	**Investigation**	**Modern Tool Usage**	**Environment and Sustainability**	**Ethics**	**Individual and Team Work**	**Project Management**	**Life-Long Learning**		
Sem I	INORGANIC CHEMISTRY - I	*	*	*	*			*	*	*	*	
	ORGANIC CHEMISTRY - II	*	*	*						*		

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	PHYSICAL CHEMISTRY - I	*	*	*	*		*			*		*
	GROUP THEORY & SPECTROSCOPY - I	*	*	*	*						*	
Sem II	INORGANIC CHEMISTRY II	*	*	*						*		*
	ORGANIC CHEMISTRY II	*	*	*								
	PHYSICAL CHEMISTRY II										*	
	SPECTROSCOPY II & DIFFRATION METHODS	*	*	*								
Sem III	APPLICATION OF SPECTROSOPY - I	*	*	*								
	PHOTOCHEMISTRY	*	*								*	
	ENVIRONMENTAL	*	*									
	Polymers	*	*									*

Sem IV	APPLICATION OF SPECTROSCOPY -II (COMPULSORY)					*		*			*	
	SOLID STATE CHEMISTRY (COMPULSORY)	*									*	
	BIOCHEMISTRY (COMPULSORY)	*	*									*
		*	*	*							*	

(08) <u>Structure of Programme</u>: To fulfill the need of development of all the POs/ GAs, as per above mapping, the following semester wise programme structure are as under.

<u>[L= Lecture, T = Tutorials, P = Practical's & C = Credits]</u>

Total Hrs.*= 160 Hrs.

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Structure of MSc program:

S. No.	Course Category	Hours of the MSc Chemistry Curriculum
1.	INORGANIC CHEMISTRY - I	11
2.	ORGANIC CHEMISTRY - II	24
3.	PHYSICAL CHEMISTRY - I	19
4.	GROUP THEORY & SPECTROSCOPY - I	20
5.	INORGANIC CHEMISTRY II	18
6.	ORGANIC CHEMISTRY II	18
7.	PHYSICAL CHEMISTRY II	18
8.	SPECTROSCOPY II & DIFFRATION METHODS	24
9.	COMPUTERS FOR CHEMISTS	19
10.	APPLICATION OF SPECTROSOPY - I	18
11.	PHOTOCHEMISTRY	18
12.	ENVIRONMENTAL	18
13.	Polymers	18
14.	Industrial Chemistry-(Heavy Chemicals & Petroleum)	24
15.	APPLICATION OF SPECTROSCOPY-II (COMPULSORY)	19
16.	SOLID STATE CHEMISTRY (COMPULSORY)	
17.	BIOCHEMISTRY (COMPULSORY)	
18.	INDUSTRIAL CHEMISTRY - PESTICIDES & GLASS INDUSTRIES	
19.	CHEMISTRY OF NATURAL PRODUCTS	
	Total	

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***Definition of Credit:**

1 Hr. Lecture (L) per week	1 Credit
1 Hr. Tutorial (T) per week	1 Credit
1 Hr. Practical (P) per week	0.5 Credit
2 Hours Practical (Lab)/week	1 Credit

Programme Structure: The M.Sc. Microbiology programme is a two-year course divided into four-semesters. A student is required to complete ninety-six credits for the completion of course and the award of degree. A student has to accumulate twenty-four credits in each of the four semesters.

Part – I	**First Year**	**Semester I**	**Semester II**
Part -II	**Second Year**	**Semester III**	**Semester IV**

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Scheme of Examination

I Semester

M.SC CHEMISTRY FIRST SEMESTER												
SUBJECT CODE	COMPULSORY/ OPTIONAL	SUBJECT NAME	THEORY						PRACTICAL		TOTAL	
			PAPER		CCE / INTERNAL		TOTAL MARKS		MAX	MIN	MAX	MIN
			MAX	MIN	MAX	MIN	MAX	MIN				
CHE-101	COMPULSORY	INORGANIC CHEMISTRY - I	70	25	30	10	100	35	33	12	133	47
CHE-102	COMPULSORY	ORGANIC CHEMISTRY - II	70	25	30	10	100	35	33	12	133	47
CHE-103	COMPULSORY	PHYSICAL CHEMISTRY - I	70	25	30	10	100	35	33	12	133	47
CHE-104	COMPULSORY	GROUP THEORY & SPECTROSCOPY - I	70	25	30	10	100	35				
OPTIONAL PAPER SELECTED ANY ONE												
CHE-105 A	OPTIONAL	MATHEMATICS OF CHEMISTS (FOR STUDENTS WITHOUT MATHMATICS IN B.SC)	70	25	30	10	100	35	0	0	100	35
CHE-105 B	OPTIONAL	BIOLOGY FOR CHEMIST (FOR STUDENTS WITHOUT BIOLOGY IN B.SC)	70	25	30	10	100	35	0	0	100	35

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SECOND SEMESTER

SUBJECT CODE	SUBJECT NAME	THEORY		CCE / INTERNAL		PRACTICAL		Total	
		MAX	MIN	MAX	MIN	MAX	MIN	Max	Min
CHE201	INORGANIC CHEMISTRY II	70	25	30	11	-	-	100	36
CHE202	ORGANIC CHEMISTRY II	70	25	30	11	-	-	100	36
CHE203	PHYSICAL CHEMISTRY II	70	25	30	11	-	-	100	36
CHE204	SPECTROSCOPY II & DIFFRATION METHODS	70	25	30	11	-	-	100	36
CHE205	COMPUTERS FOR CHEMISTS	70	25	30	11	-	-	100	36
CHE 206	Lab (INORGANIC CHEMISTRY II+ ORGANIC CHEMISTRY II+ PHYSICAL CHEMISTRY II)	-	-	-	-	100	36	100	36

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Third Semester

SUBJECT CODE	COMPULSORY / OPTIONAL	SUBJECT NAME	THEORY						PRACTICAL		TOTAL	
			PAPER		CCE / INTERNAL		TOTAL MARKS		MAX	MIN	MAX	MIN
			MAX	MIN	MAX	MIN	MAX	MIN				
CHE301	COMPULSORY	APPLICATION OF SPECTROSOPY - I	70	28	30	10	100	38	0	0	100	38
CHE302	COMPULSORY	PHOTOCHEMISTRY	70	28	30	10	100	38	0	0	100	38
CHE303	COMPULSORY	ENVIRONMENTAL	70	28	30	10	100	38	0	0	100	38
CHE304	COMPULSORY	Polymers	70	28	30	10	100	38	0	0	100	38
CHE305	COMPULSORY	Industrial Chemistry-(Heavy Chemicals & Petroleum)	70	28	30	10	100	38	0	0	100	38
CHE306	COMPULSORY	INTERNSHIP	0	0	0	0	0	0	100	36	100	36
CHE307	COMPULSORY	LAB (InorgnicChemistry)	0	0	0	0	0	0	33	12	33	12
CHE308	COMPULSORY	LAB (orgnic Chemistry)	0	0	0	0	0	0	33	12	33	12
CHE309	COMPULSORY	LAB (Physical Chemistry)	0	0	0	0	0	0	34	12	34	12

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Fourth- Semester

Code	Subject	CCE/INTERNAL		Theory		Practical		Total	
		Max	Min	Max	Min	Max	Min	Max	Min
CHE401	APPLICATION OF SPECTROSCOPY-II (COMPULSORY)	30	11	70	25	-	-	100	36
CHE402	SOLID STATE CHEMISTRY (COMPULSORY)	30	11	70	25	-	-	100	36
CHE403	BIOCHEMISTRY (COMPULSORY)	30	11	70	25	-	-	100	36
	Choose any one from code 404								
CHE404 (A)	MEDICINAL CHEMISTRY	30	11	70	25	-	-	100	36
CHE404 (B)	ELECTROCHEMISTRY								
	Choose any one from code 405								
CHE405 (A)	INDUSTRIAL CHEMISTRY - PESTICIDES & GLASS INDUSTRIES	30	11	70	25	-	-	100	36
CHE405 (B)	CHEMISTRY OF NATURAL PRODUCTS								
CHE406	PRACTICAL -INORGANIC CHEMISTRY	-	-	-	-	33	12	33	12
CHE407	PRACTICAL- ORGANIC CHEMISTRY	-	-	-	-	33	12	33	12
CHE408	PRACTICAL- PHYSICAL CHEMISTRY	-	-	-	-	34	12	34	12

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Semester-I

Paper-I: Inorganic Chemistry

CHE-101	**Inorganic Chemistry**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

Unit-I **6 Hrs.**

Stereochemistry and Bonding in Main Group Compounds

Valence shell electron pair repulsion (VSEPR) theory and its applications, Walsh diagram (triatomic molecules), dл-pл bond, Bent rule and energetic of hybridization, some simple reactions of covalently bonded molecules such as Atomic inversion, Berry pseudoration, Nucleophilic displacement, free radical mechanisms.

Unit - ll **6 Hrs.**

Metal Ligand bonding

Limitation of crystal field Theory, Jahn -Teller effect, molecular orbital theory for bonding in octahedral, tetrahedral and square planar complexes

Unit - lll **6 Hrs.**

Metal -Ligand Equilibrium in Solution

Stepwise and overall formation constants and their relationship, trends in stepwise constant, factors 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 pH metry and Spectrometry.

Unit - IV **6 Hrs.**

Reaction Mechanism of Transition Metal Complexes - I

Energy Profile of a reaction, reactivity of metal complex, inert and labile complexes, Kinetic application of valence bond and crystal field theories. Kinetics of octahedral substitution, acid hydrolysis, factors affecting acid hydrolysis, base hydrolysis, conjugate base mechanism, direct and

indirect evidences in favour of conjugate mechanism, anion reactions, reactions without metal ligand bond cleavage. Substitution reaction in square planer complexes, the trans effect, Mechanism of substitution reactions.

Unit-V **6 Hrs.**

Reaction Mechanism of Transition Metal Complexes - II and HSAB theory

Redox reaction, Electron transfer reaction, mechanism of one electron transfer reaction, outer and inner sphere type reactions, cross reactions and Marcus - Hush theory, HSAB principle, Theoretical basis of hardness and softness, Lewis - acid base reactivity approximation; donar acceptor numbers, E and C equation : applications of HSAB concept.

Books suggested

1. Advanced Inorganic Chemistry, F. A. Cotton and Wilkinson, John Wiley.
2. Inorganic Chemistry, J.E. Huhey, Harpes & Row.
3. Chemistry of Elements. N. N. Greenwood and A. Earnshow, Pergamon
4. Inorganic Electronic Spectroscopy, A.B. P. Lever, Elsevier.
5. Comprehensive Co-ordination Chemistry eds., G. Wilkinson, R.D. Gillars and J. A. Mc clevetry, Pergamon.

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Semester-I
Paper-II: Organic Chemistry

CHE-102	**Organic Chemistry**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

Unit-I **6 Hrs.**

Nature of Bonding in Organic Molecules

Delocalized chemical bonding: conjugation, cross conjugation, resonance, hyperconjugation, bonding in fullerenes, tautomerism. Aromaticity in benzenoid and non-benzenoid compounds, alternate and non-alternate hydrocarbons. Huckel's rule, Energy level of -molecular orbitals, annulenes, anti-aromaticity, homo-aromaticity, PMO approach. Bonds weaker than covalent-addition compounds, crown ether complexes and cryptands, inclusion compounds, catenanes and rotaxanes.

Unit - II **6 Hrs.**

Stereochemistry

Strain due to unavoidable crowding. Elements of symmetry, chirality, molecules with more than one chiral center, threo and erythro isomers, methods of resolution, optical purity, enantiotopic and diastereotopic atoms, groups and faces, stereospecific and stereoselective synthesis, Asymmetric synthesis. Optical activity in absence of chiral carbon in biphenyls, allenes and spiranes, Chirality due to helical shape. Stereochemistry of the compounds containing nitrogen, sulphur and phosphorus.

Unit - III **6 Hrs.**

Confomational analysis and Linear free energy relationship

Conformational analysis of cycloalkanes, decalines, effect of conformation on reactivity, conformation of sugars. Generation, structure, stability and reactivity of carbocations, carbanions, free radicals, carbenes and nitrenes. The Hammett

equation and Linear free energy relationship, substituents and reaction constants, Taft equation.

Unit - IV **6 Hrs.**

Reaction Mechanism : Structure and Reactivity

Types of mechanism, types of reactions, thermodynamic and kinetic requirements, Kinetic and thermodynamic control, Hammond's Postulate, Curtin-hammett principle. Potential energy diagrams, transition states and intermediates, methods of determining mechanisms, isotopic effects.

Unit - V **6 Hrs.**

Aliphatic Nucleophilic Substituition

The SN2, SN1, mixed SN1 and SN2 and SEI mechanism. The neighbouring group mechanism. neighbouring group participation by pi and sigma bonds, anchimeric assistance**.** Classical and non classical carbocations, phenonium ions, norbornyl systems, common carbocation rearrangements. Application of NMR spectroscopy in the detection of carbocations. The SNi mechanism. Nucleophilic substitution at an allylic, trigonal and a vinylic carbon. Reactivity effects of substrate structure, attacking nucleophile, leaving group and reaction medium, phase transfer catalysis and ultrasound, ambident nucleophiles, regioselectivity.

Book Suggested

1. Advanced Organic Chemistry - Reactions, Mechanism and Structure, Jerry March, John Wiley.
2. Advanced Organic Chemistry, F.A. Carey and R.J. Sunderg, Plenum.
3. A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.
4. Organic Chemistry, R.T. Morrison and R.N. Boyd, Prentice - Hall.

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Semester-I
Physical Chemistry –I

CHE-103	**Physical Chemistry –I**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

Unit - I **6 Hrs.**

Introduction to Exact Quantum Mechanical Results : Schrodinger equation and the postulates of quantum mechanics. Discussion of solutions of the schrodinger equation to some model systems viz., particle in a box, the harmonic oscillator, the rigid rotor, the hydrogen atom and helium atom.

Unit - II **6 Hrs.**

Approximate methods: The variation theorm, linear variation principle. Perturbation theory (First order and nondegenerate). Applications of variation method and perturbation theory to the Helium atom.

Molecular Orbital Theory: Huckel theory of conjugated systems bond and charge density calculation. Applications to ethylene, butadiene, cyclopropenyl radical cyclobutadiene etc. Introduction to extended Huckel theory.

Unit - III **6 Hrs.**

Angular Momentum: Ordinary Angular Momentum, generalized angular momentum, eigen fucntions for Angular Momentum, eigenvalues of Angular Momentum, operator using ladder operators addition of angular momenta, spin, antisymmetry and Pauli exclusion principle.

Unit - IV **6 Hrs.**

Classical Thermodynamics: Brief resume of concepts of laws of thermodynamics, free energy, chemical potential and entropies. Partial molar free energy, Partial molar volume and Partial molar heat content and their significance, Determinations

of their quantities. Concents of fugacity and determination of fugacity. Non-ideal systems : Excess functions for non-ideal solutions. Activity, activity coefficient, Debye Huckel theory for activity coefficient of electrolytic solutions; determination of activity and activity coefficients; ionic strength. Application of phase rule to three component systems; second order phase transition.

Unit - V **6 Hrs.**

Statistical Thermodynamics: Concept of distribution, thermodynamics probability and most probable distribution. Ensenble averaging, postulates of ensemble averaging. Canonical, grand canonical and micro-canonical ensembles. Corresponding distribution laws (using Lagrange's method of undeteremined multipliers). Partition functions-translation, rotational, vibrational and electronic partition functions. Calculation of thermodynamics probability in terms of partition. Application of partition functions. Fermi-Dirac Statistics, distribution law and application to metal. Bose-Einstein statistics distribution Law and application to helium.

Books Suggested:

1. Physical Chemistry, P.W. Atkins, ELBS.
2. Introduction to Quantum Chemistry, A.K. Chandra. Tata Mc Graw Hill.
3. Quantum Chemistry, Ira N. Levine, Prentice Hall.
4. Couison's Valence, R.Mc Weepy, ELBS.
5. Chemical Kinetic. K. J. Laidler, MoGraw-Hill.

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Semester-I

Paper-I: Group Theory and Spectroscopy

CHE-104	**Group Theory and Spectroscopy**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

Unit – I **6 Hrs.**

Symmetry and Group theory in Chemistry: Symmetry elements and symmetry operation, definition of group, subgroup. Conjugacy relation and classes.Point symmetry group. Schoenflies symbols, representations of groups by matrices (representation for the C_n,C_{nv},C_{nh}, and D_{nh} group to be worked out explicity). Character of a representation. The great orthogonality theorem (without proof)and its importance. Character tables and their use; spectroscopy. Derivation of character.table for C_{2v} and C_{3v} point group Symmetry aspects of molecular vibrations of H_20 molecule.

Unit - II **6 Hrs.**

Microwave Spectroscopy: Electromagnetic spectrum, Quantization of energy, Interaction of electromagnetic radiation with molecular system, Doppler broadening. Pure rotational Spectra: Instrumentation, rigid rotator model, effect of isotopic substitution on the transition frequencies, non-rigid rotator model, Stark effect, Application of rotational spectra to the calculation of bond length of diatomic molecules.

Unit - III **6 Hrs.**

Infrared-Spectroscopy: Review of linear harmonic oscillator,Vibrational energies of diatomic molecules, zero point energy, force constant and bond strengths; anharmonicity, Morse potential energy diagram, vibration-rotation spectroscopy. P.Q.R. branches, Breakdown of Oppenheimer approximation; vibrations of polyatomic molecules. Selection rules, normal modes of vibration, group frequencies, overtones, hot bands, factors affecting the band positions and

intensities, far IR region, metal ligand vibration, normal co-ordination analysis.

Books suggested:

1. Modern Spectroscopy, .l.M. Hollas, John Viley.
2. Applied Electron Spectroscopy for chemical analysis d. H. Windawi and FL. Ho, Wiley Interscience.
3. NMR, NQR, EPr and Mossbauer Spectroscopy in Inorganic Chemistry, R,V. Parish, Ellis Harwood.
4. Physical Methods in Chemistry, R.S. Drago, Saunders College.

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BIOLOGY FOR CHEMISTS (Optional)
CHE104B

CHE-104 B	**BIOLOGY FOR CHEMISTS (Optional)**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

(For student s without Biology in B.Sc.)

Unit –I **6 Hrs.**

Cell Structure and functions

Structure prokaryotic and eukaryotic cells, intracellular organelles and their functions, comparison of plant and animals cells. Over for view and their functions, comparison of plant and animals 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 bio-molecules, building of bio-macromolecules.

Unit- II **6 Hrs.**

Carbohydrates

Conformation of monosaccharide's structure and functions of important derivatives of mono-saccharides 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. Structure and biological functions of glucosminoglyscans of mucopolysaccharides Carbohydrates of glycorporteins and gloycolipds. Role of sugars in biological recognition, Blood group substance. Ascorbic acid.

Unit-III **6 Hrs.**

Lipid : Fatty acids, essential fatty acids, structure and functions of triacylglycerols, glycerophospholipids, Spingolipids, cholesterol, bile acids, prostaglandins. Liproproteins-composition and function, role in atherosclerosis. Properties of lipid aggregates-micelles, bilayers, liposomes and their possible biological functions. Biological membrance. Fluid mosaic model of membrane structure . lipid metabolism b-oxidation of fatty acids.

Unit-IV **6 Hrs.**

Amino- acids, peptides and proteins

Chemical and enzymatic hydrolysis of proteins to peptides, amino acid sequencing, Secondary Structure of proteins. Force responsible for holding of secondary structures. A- helix, b-sheetsm super secondary structure, triple helix structure of collagen. Tertiary structure of protein-folding and domina structure, quaternary structure. Amino acid metabolism-degradation and biosynthesis of amino acide, sequence determination: chemical/enzymatic/mass spectral, racemization/detection. Chemistry of oxytocin and tryptophan releasing honrmone (TRH)

Unit V **6 Hrs.**

Nucleic Acids

Purine and pyrimidine bases of nucleic acids, base pairing via Hbounding Structure of ribonucleic acids (RNA) and deoxyribonucleic acid (DNA), double helix model of DNA and forces responsible for holding it, Chemical and enzymatic hydrolysis of nucleic acids . The chemical basis for heredity, and overview of replication of DNA, transcription, translation and genetic code, chemicals synthesis of mono and trinucleoside

Book Suggested:

1. Principles of Biochemistry , A.L. Lehninger, Worth Publisher.
2. Biochemistry, L. Stryer, W.H. Freeman,
3. Biochemistry, J. David Rawan Neli. Patterson.
4. Biolchemistry, Voet and Voet, John Wiley \
5. Outlines of Biochemistry E.E. Conn and P.K. Stumpf, John Wiley

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CHE105

(For students without Mathematics in B.Sc.)

Unit –I **6 Hrs.**

Vectors: Vectors, dot, cross and triple products etc. gradient, divergence and curl, vector Calculus. **Matrix Algebra:** Addition and multiplication; inverse, adjoint and transpose of matrices.

Unit –II **6 Hrs.**

Differential Calculus

Functions, continuity and differentiability, rules for differentiation, application of differential calculus including maxima and minima (examples related to maximally populated rotational energy levels, Bohr's radius and most probable velocity from Maxwell's distribution etc)

Unit-III **6 Hrs.**

Integral calculus

Basic rules for integration, integration by parts, partial fractions and substitution, Reduction formulae, application of integral calculus,

Functions of several variables, partial differentiation, co-ordinate transformation (e.g. Cartesian to Spherical polar).

Unit-IV **6 Hrs.**

Elementary Differential equations

First-order and first degree differential equations, homogenous, exact and liner equations Applications to chemical kinetics , Secular equilibria, quantum chemistry etc, second order differential equation and their solutions.

Unit-V **6 Hrs.**

Permutation and Probability Permutation and combinations, probability and probability theorems average, variance root means square deviation examples from the Kinetic theory of gases etc. fitting (including least squares fit etc with a general polynomial fit.

Book Suggested

1. The Chemistry Mathematics Book, E. Steiner, Oxford University press.
2. Mathematics for chemistry, Doggett and Suiclific, Logman,
3. Mathematics for physical Chemistry: Daniels, Mc. Graw Hill.

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Semester-II

Paper: INORGANIC CHEMISTRY II

CHE-201	INORGANIC CHEMISTRY II	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

Unit-1 6 Hrs.

Electronic Spectral Studies of Transition Metal Complexes : Spectroscopic ground states, correlation. Orgel and Tanabe-Sugano diagrams for transition metal complexes (d1-d9 states), Selection rule for electronic spectroscopy. Intensity of various type electronic transitions. Calculations of 10Dq, B and β parameters, charge transfer spectra.

Unit–2 6 Hrs.

Magnetic Properties of Transition Metal Complexes

Types of magnetic bodies, two sources of paramagnetism, orbital and spine effect, Curie equation and Curic wles law, Determination of magnetic susceptibilty, Quenching of orbital contribution. Anomalous magnetic moments. Spin-Cross over and magnetic exchange coupling.

Unit-3 6 Hrs.

Metal ∏ Complexes Metal carbonyl, structure and bonding, vibrational spectra of metal carbonyls for bonding and structural elucidation, important reactions of metal carbonyls; preparation, bonding , structure and important reaction of transition metal nitrosyl, dinitrogen and dioxygen complexes; tertiary phosphine as ligand.

Unit-4 6 Hrs.

Metal Clusters

Higher boranes, carboranes, metalloboranes and metallo-carboranes compounds dinuclear, trinuclear, tetranuclear, hexanuclear clusters with metal metal multiple bonds.

Unit-5 6 Hrs.

Optical Rotatory Dispersion and Circular Dichroism

Linearly and circularly polarized lights; optical rotatory power and circular birefringence, elipticity and circular dichroism; ORD and Cotton effect, Faraday and Kerr effects; Assignment of electronic transitions; applications of ORD and CD for the determination of (i) absolute configuration of complexes and (ii) isomerism due to non-planarity of chelate rings.

Reference Book :-

Advanced Inorganic Chemistry, F.A. Cotton and Wilkinson, John Wiley.

Inorganic Chemistry, J.E. Huhey, Harpes & Row.

Chemistry of the Elements. N.N. Greenwood and A. Earnshow, Pergamon.

Inorganic Electronic Spectroscopy, A.B.P. Lever, Elsevier.

Paper - ORGANIC CHEMISTRY II

CHE-202	**ORGANIC CHEMISTRY II**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

Unit-1

Aromatic Electrophilic Substitution The arenium ion mechanism, orientation and reactivity, energy profile diagrams. The ortho/para ratio, ipso attack, orientation in other ring systems. Quantitative treatment of reactivity in substrates and electrophiles. Diazonium coupling, Vilsmeir reactiion, Gatterman-Koch reaction .

Aromatic Nucleophilci Substitution The SNAr SN1, benzyne and SN1 mechanism, Reactivity effect of substrate structure, leaving group and attacking nucleophile. The Von Richte. Sommelet-Hauser, and Smiles rearrangements.

Unit–2

Free Radical Reactions

types of free radical reactions, free radical substitution mechanism, mechanism at an aromatic substrate, neighbouring group assistance. Reactivity for aliphatic and aromatic substrates at a

bridgehead. Reactivity in the attacking radicals. The effect of solvents on reactivity. Allylic halogenation (NBS), oxidation of aldehydes to carboyxlic acids, auto-oxidation, coupling of alkynes and arylation of aromatic compounds by diazonium salts, Sandmeyer reaction. Free radical rearrangement. Hunsdiecker reaction.

Unit-3

Addition Reactions

Mechanism and stereochemical aspects of addition reactions involving electrophiles, nucleophiles and free radicals, regio-and chemoselectivity, orientation and reactivity. Addition to cyclopropane ring. Hydrogenation of double and triple bounds, hydrogenation of aromatic rings. Hydroboration, Michael reaction, sharpless asymmetric epoxidation.

Unit-4

Addition to Carbon-Hetero Multiple bonds

Mechanism of metal hydride reduction of saturated and unsaturated carbonyl compounds, acid esters and nitriles. Addition of Grignard reagents, organozinc and organolithium reagents to carbonyl and usaturated carbonyl compounds. Witting reaction. Mechanism of condensation reactions involving enolates-Aldol, Knoevenagel, Claisen, Mannich, Benzoin, Perkin and Stobbe reactions. Hydrolysis of esters and amides, ammonolysis of esters.

Elimination Reactions

The E2, E1 and E1 cB mechanisms and their spectrum. Orientation of the double bond. Reactitivty-effects of substrate structures, attacking base, the leavign group and the medium. Mechanism and orientation in pyrolytic elimination.

Unit-5

Pericyelic Reactions Molecular orbital symmetry, Frontier orbitals of ethylene, 1,3-butadiene, 1,3,5-hexatriene and allyl system. Classification of periycyclic reactions. Woodward-Hoffmann correlation diagrams. FMO and PMO approach. Electrocyclic reactions-conrotatory and disrotatory motions, 4n 4n+2 and ally! systems. Cycloadditions-antarafacial and suprafacial additions, 4n and 4n+2 systems, 2+2 addition of ketenes, 1,3 dipolar cycloadditions and cheleotrpic reactions. Sigmatropic rearrangements-suprafacial and antarafacial shifts of H, sigmatropic involving carbon moieties, 3,3- and 5,5 sigmatropic rearrangements. Claise n, Cope

and aza-Cope rearrangements. Fluxional tautornerism, Ene reaction.

Reference Book :-

Advanced Organic Chemistry-Reactions, Mechanism and Structure, Jerry

March, John Wiley.

Advanced Organic Chemistry, F.A. Carey and R.J. Sunderg, Plenum.

A Guide Book to Mechanism in Organic Chemistry, Peter Sykes, Longman.

Structure and Mechanism in Organic Chemistry, C.K. Ingold, Cornell University Press.

UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Chemistry

Paper: PHYSICAL CHEMISTRY II

CHE-203	**PHYSICAL CHEMISTRY II**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

Unit-1

Chemical Dynamics

Methods of determining rate laws, collision theory of reaction rates, steric factor, activated complex theory, Arrhenius equation and the activated complex theory; ionic reactions, kinetic salt effects, steady state kinetics, kinetic and thermodynamic control of reactions, treatment of unimolecular reactions. Dyamic chain (hydrogenbromine reaction, pyrolysis of acetaldehyde, decomposition of ethane), photochemical (hydrogen-bromine and hydrogen-chlorine reactions) and homogenous catalysis, kinetics of enzyme reactions, general features fo fast reactions, study of fast reactions by flow method, relaxation method, flash photolysis ad the nuclear magnetic

resonance method, dynamics of unimolecular reactiosn (Lindemann Hinshelwood and Rice-RamspergerKassel-Marcus (RRKM) theories for unimolecular reactions).

Unit–2

Surface Chemistry :-

Adsorption Surface tension, capillary action, pressure difference across curved surface (Laplace equation), vapour pressure of droplets (Kelvin equation), Gibbs adsorption isotherm, estimation of surface area (BET equation), Surface films on liquids (Electro-kinetic phenomenon).

Micelles Surface active agents, classification of surface active agents, micellization, hydrophobic interaction, critical micellar concentration (CMC), factors affecting the CMC of surfactants,

counter ion binding to micelles, thermodynamics of micellization-phase separation and mass action models, solublization, micro emulsion, reverse micelles.

Unit-3

Macromolecules:

Polymer-definition, types of polymers, electrically conducting, fire resistant, liquid crystal polymers, kinetics of polymerization, mechanism of polymerization. Molecular mass, number and mass average molecular mass, molecular mass determination (Osmometry, viscometry, diffusion and light scattering methods), sedimentation, chain configuration of macromolecules, calculation of average dimension of various chain structures.

Unit-4

Non Equilibrium Theromodynamics

Thermodynamic criteria for non-equilibrium states, entropy production and entropy flow, entropy balance equations for different irreversible processes (e.g., heat flow, chemical reaction etc.) transformations of the generalized fluxes and forces, non equilibrium stationary states, phenomenological equations, microscopic reversibility and Onsager's reciprocity relations, electrokinetic phenomena, diffusion, electric conduction.

Unit-5

Electrochemistry

Electrochemistry of solutions, Debye-Huckel-Onsager treatment and its extension, ion solvent interactions. Debye-Huckel-Jerum mode. Thermodynamics of electrified interface equations. Derivation of electro capillarity, Lippmann equations (surface excess), methods of determination. Structure of electrified interfaces. Overpotentials, exchange current density, derivation of Butler Volmer equation, Tafel plot. Quantum aspects of charge transfer at electrodes-solution interfaces, quantization of charge transfer, tunneling. Semiconductor interfaces-theory of double layer at semiconductor, electrolyte solution interfaces, structure of double layer interfaces. Effect of light at semiconductor solution interface. Polarography theory, Ilkovic equation; half wave

potential and its significance.

Reference Book :-

Physical Chemistry, P.W. Atkins, ELBS.

Introduction to Quantum Chemistry, A.K. Chandra, Tata Mc Graw Hill.

Paper: Spectroscopy II and Diffraction Methods

CHE- 204	**Spectroscopy II and Diffraction Methods**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

Unit-1

Nuclear Magnetic Resonance Spectroscopy

Nuclear spin, nuclear resonance, saturation, shielding of magnetic nuclei, chemical shift and its measurements, factors, influencing chemical shift, deshielding, spin-spin interactions, factors influencing coupling constant "j" Classification (AXB, AMX, ABC, A2B2 etc.). spin decoupling; basic ideas about instrument, NMR studies of nuclei other than protin-13C, 19F and 31P. FT NMR, advantages of FT NMR.

Unit–2

Nuclear Quadrupole Resonance Spectroscopy

Quadrupole nuclei, quadrupole moments, electric field gradient, coupling constant, splitting.

Applications.

Unit-3

Electron Spin Resonance Spectroscopy

Basic principles, zero field splitting and Kramer's degeneracy, factors affecting the 'g' value. Isotropic and anisotropic hyperfine coupling constants, spin Hamiltonian, spin densities and Mc Connell relationship, measurement techniques, applications.

Unit-4

X-ray Diffraction

Bragg condition, Miller indices, Laue Method, Bragg method, Debye Scherrer method of X-ray structural analysis of crystals, index reflections, identification of unit cells from systematic absences in diffraction pattern, Structure of simple lattices and X-ray intensities, structure factor and its relation to intensity and electron density, phase problem. Description of the procedure for an X-ray structure analysis, absolute configuration of molecules.

Unit-5

Electron Diffraction

Scattering intensity vs. scattering angle, Wierl equation, measurement technique, elucidation of structure of simple gas phase molecules. Low energy electron diffraction and structure of surfaces. **Neutron Diffraction** Scattering of neutrons by solids measurement techniques, Elucidation of structure of agnetically ordered unit cells.

Third Semester

Paper- APPLICATION OF SPECTROSOPY

Code- CHE301

CHE301	**APPLICATION OF SPECTROSOPY**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

UNIT-I

Vibrational Spectroscopy

Symmetry and shapes of AB2, AB3, AB4, AB5 and AB6, mode of bonding of ambidentate ligands, nitrosyl, ethylenediamine and diketonato complexes, application of resonance Raman spectroscopy particulary for the study of active sites of meteloprotein.

UNIT- II

Electron Spin Resonance Spectroscopy

Hyperfine coupling, spin polarization for atoms and transition metal ions, spin-orbit coupling and significance of g- tensors, application to transition metal complexes (having one unpaired electron) including biology systems and to inorganic free radicals.

UNIT-III

Nuclear Magnetic Resonance Of Paramagnetiv Substances in Solution

Properties of paramagnetic compound, The contact and Pseudo contact shifts. Factors affecting nuclear relaxation. Contrast agents, shifts reagent, some applications including biochemical systems on overview of NMR of metal nucide with emphasis on ^{195}Pt and ^{119}Sn NMR.

UNIT-IV

Mossbauer Spectroscopy

Basic principles, instrumentation, chemical shift, spectral display, Application of the technique to the studies of (1) bonding and structures of Fe+2 and Fe+3 compounds including those of intermediate spin, (2) Sn+2 and Sn+4 compounds nature of M-L bond, coordination number, structure and (3) detection of oxidation state and inequivalent MB atoms.

UNIT- V

Electron Spectroscopy

Electronic Spectral Studies for d^1- d^9 systems in octahedral, tetrahedral and square planar complexes.

Suggested Readings :

1. Physical Methods for Chemistry, R.S. Drago, Saunders Compnay.

2. Structural Methods in Inorganic Chemistry, E.A.V. Ebsworth, D.W.H. Rankin and S. Cradock, ELBS.

3. Infrared and Raman Spectral : Inorganic and Coordination Compounds K. Nakamoto, Wiley.

4. Progress in Inorganic Chemistry vol., 8, ed., F.A. Cotton, vol., 15 ed. S.J. Lippard, Wiley.

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SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Chemistry

Paper-PHOTOCHEMISTRY

CHE302

CHE302	**PHOTOCHEMISTRY**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

UNIT-I

Photochemical Reactions

Interaction of electromagnetic radiation with matter, types of excitations, fate of excited molecule, quantum yield, transfer of excitation energy, actinometry.

UNIT-II

Determination of Reaction Mechanism

Classification, rate constants and life times of reactive energy state, determination of rate constants of reactions. Effect of light intensity on the rate of photochemical reactions. Types of photochemical reactions-photo dissociation, gas-phase photolysis. A'.1.

UNIT-III

Photochemistry of Alkenes

Intramolecular reactions of the olefinic bond-geometrical isomerism, cyclisation reactions, rearrangement of 1,4- and 1,5-dienes.**Photochemistry of Aromatic Compounds** Isomerisations, additions and substitutions.

UNIT-IV

Photochemistry of Carbonyl Compounds

Intramolecular reactions of carbonyl compounds-saturated, cyclic and acyclic, b,g unsaturated and a, b unsaturated compounds, cyclohexadienones. Intermolecular cyloaddition reactions-dimerisations and oxetane formation.

UNIT-V

Miscellaneous Photochemical Reactions Photo-Fries reactions of annilid's, Photo-Fries rearrangement. Barton reaction. Singlet molecular oxygen reactions. Photochemical formation of smog. Photodegradation of polymers. Photochemistry of vision.

Suggested Readings :

1. Physical Methods for Chemistry, R.S. Drago, Saunders Compnay.

2. Structural Methods in Inorganic Chemistry, E.A.V. Ebsworth, D.W.H. Rankin and S. Cradock, ELBS.

3. Infrared and Raman Spectral : Inorganic and Coordination Compounds K. Nakamoto, Wiley.

4. Progress in Inorganic Chemistry vol., 8, ed., F.A. Cotton, vol., 15 ed. S.J. Lippard, Wiley.

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SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Chemistry

Paper - ENVIRONMENTAL

CHE303

CHE303	**ENVIRONMENTAL**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

UNIT-I

Atmosphere

Atmospheric layers, Vertical temperature profile, heat/radiation budget of the earth atmosphere systems. Properties of troposphere, thermodynamic derivation of lapse rate. Temperature inversion. Calculation of Global mean temperature of the atmosphere. Pressure variation in atmosphere and scale height. Bio geochemical cycles of carbon, nitrogen, sulphur, phosphorus, oxygen. Residence times.

Atmospheric Chemistry

Sources of trace atmospheric constituents : nitrogen oxides, sulphurdioxide and other sulphur compounds, carbon oxides, chlorofluorocarbons and other halogen compounds, methane and other hydrocarbons.

Tropospheric Photochemistry

Mechanism of Photochemical decomposition of NO_2 and formation of ozone. Formation of oxygen atoms, hydroxyl, hydroperoxy and organic radicals and hydrogen peroxide. Reactions of hydroxyl radicals with methane and other organic compounds. Reaction of OH radicals with SO_2 and NO_2. Formation of Nitrate radical and its reactions. Photochemical smog meteorological conditions and chemistry of its formation.

UNIT-II

Air Pollution Air pollutants and their classifications. Aerosols-sources, size distribution and effect on visibility, climate and health.

Acid Rain

Definition, Acid rain precursors and their aqueous and gas phase atmospheric oxidation reactions. Damaging effects on aquatic life, plants, buildings and health. Monitoring of SO_2 and NO_2. Acid rain control strategies.

Stratospheric Ozone Depletion

Mechanism of Ozone formation, Mechanism of catalytic ozone depletion, Discovery of Antarctic Ozone hole and Role of chemistry and meteorology. Control Strategies. **Green House Effect** Terrestrial and solar radiation Spectra, Major green house gases and their sources and Global warming potentials. Climate change and consequences.

Urban Air Pollution Exhaust emissions, damaging effects of carbon monoxide. Monitoring of CO. Control strategies.

UNIT-III

Aquatic Chemistry and Water Pollution

Redox chemistry in natural waters. Dissolved oxygen, biological oxygen demand, chemical oxygen demand, determination of DO, BOD and COD. Aerobic and anaerobic reactions of organic sulphur and nitrogen compounds in water acid-base chemistry of fresh water and sea water. Aluminum, nitrate and fluoride in water. Petrification. Sources of water pollution. Treatment of waste and sewage. Purification of drinking water, techniques of purification and disinfection.

UNIT-IV

Environmental Toxicology

Toxic heavy metals : Mercury, lead, arsenic and cadmium. Causes of toxicity. I Bioaccumulation, sources of heavy metals. Chemical speciation of Hg, Pb, As, and Cd. Biochemical and damaging effects.

Toxic Organic Compound : Pesticides, classification, properties and uses of organochlorine and ionospheres pesticides detection and damaging effects. Polychlorinated biphenyls : Properties, use and environmental continuation and effects.

Polynuclear Aromatic Hydrocarbons : Source, structures and as pollutants.

UNIT-V

Soil and Environmental Disasters

Soil composition, micro and macronutrients, soil pollution by fertilizers, plastic an metals. Methods of re-mediation of soil. Bhopal gas tragedy, Chernobyl, three mile island, Minimtata Disease, Sevoso (Italy), London smog.

Suggested Readings :

1. Environmental Chemistry, Colin Baird, W.H. Freeman Co. New York, 1998.

2. Chemistry of Atmospheres, R.P. Wayne, Oxford.

3. Environment Chemistry, A.K. De, Wiley Eastern, 2004.

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SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Chemistry

Paper- POLYMERS

CHE304	**POLYMERS**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

UNIT-I

Basics

Importance of polymers. Basic concepts: Monomers, repeat units, degree of polymerization Linear, branched and network polymers. Classification of polymers. Polymerization: condensation, addition/radical chain-ionic and co-ordination and copolymerization. Polymerization conditions and polymer reactions. Polymerization in homogeneous and heterogeneous systems.

UNIT-II

Polymer Characterization

Poly dispersion -average molecular weight concept. Number, weight and viscosity average molecular weights. Polydispersity an molecular weight distribution. The practical significance of molecular weight. Measurement of molecular-weights. End-group, viscosity, light scattering, osmotic and ultracentrifugation methods.

UNIT-III

Analysis and testing of polymers

Chemical analysis of polymers, spectroscopic methods, X-ray diffraction study. Microscopy. Thermal analysis and physical testing-tensile strength. fatigue, impact, Tear resistance, Hardness and abrasion resistance.

UNIT-IV Inorganic Polymers

A general survey and scope of Inorganic Polymers special characteristics, classification, homo and hetero atomic polymers.

Structure, Properties and Applications of

a. Polymers based on boron-borazines, boranes and carboranes.

b. Polymers based on Silicon, silicone's polymetalloxanes and polymetallosiloxanes, silazanes.

UNIT-V

Structure, Properties and Application of Polymers

a. Polymers based on Phosphorous-Phosphazenes, Polyphosphates

b. Polymers based on Sulphur-Tetrasulphur tetranitride and related compounds.

c. Co-ordination and metal chelate polymers.

Suggested Readings :

1. Inorganic Chemistry, J.E. Huheey, Harper Row.

2. Developments in Inorganic polymer Chemistry, M.F. Lappert and G.J. Leigh.

3. Inorganic polymers- N.H. Ray.

4. Inorganic polymers, Graham and Stone.

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SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Chemistry

INDUSTRIAL CHEMISTRY- (HEAVY CHEMICALS & PETROLEUM)

CHE-305

CHE305	**INDUSTRIAL CHEMISTRY**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

UNIT-I

Water, Gases and Heavy Chemicals Water : Water Pollutants, their classes with examples, Biochemical oxygen demand, thermal pollution, pollution by fertilizers, detergents, pesticides and industrial wastes. .

Water Purification : Classical and modern Methods - Ion exchange, electrodialysis, Reverse osmosis. Softening of Hard water. Chlorination and fluoridation.

UNIT-II

Gases : Chemist!y Large-sclae production storage, hazards and uses of the following industrial gases: Hydrogen, oxygen, nitrogen, carbon dioxide, chlorine, fluoriene, sulphur dioxide, phosgene, acetylene, argon, neon and helium.

Heavy Chemicals : Manufacture, Physical properties, Analysis, Hazards and applications of the following chemicals : HCL, H_2SO_4, HNO, H_3F0_4, poly phosphoric acid, $NaHCO_3$, NA_2CO_3, NaOH, NaCL, $Na_2S_2O_3$, Bleaching Powder, Bromine.

UNIT-III

Coal & Petroleum Coal : Origin and economic importance of coal. Coal composition, Coal carbonization, Coal gasification, Coal Gas, Water Gas, Producer gas, coal tar industry and manufacture of coal tar based chemicals and their importance. Role as carcinogens, Non-fuel uses of coal, and Cl Chemistry based on MeCOOH,CH_4 and CHO

UNIT-IV

Petroleum : Origin and composition, Refining, Reforming Fractionation; Cracking; knocking and Octane number, Kerosene and Napthene; Liquified petroleum gas (I.P.G.) Synthetic Gas, Synthetic Petrol, Petrochemicals, manufacture of ethylene propylene. Butedmne, xylenes, etc. Economic importance with particular reference to India.

UNIT-V

Fats & Oils Fats & Oil Natural Fats, Edible and Industrial Oils of vegetable origin, common fatty acids and glyceride. Hydrogenation of Unsaturated oils, manufacture of Vanaspati and margarine.

Suggested Readings :

Industrial Chemistry J.S Jangwan, A. S Mathuria

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SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Chemistry

IV- Semester Syllabus

CHE401 - APPLICATION OF SPECTROSCOPY-II (Compulsory)

CHE401	**APPLICATION OF SPECTROSCOPY-II (Compulsory)**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

UNIT-I

Ultraviolet and Visible spectroscopy

Various electronic transitions (185-800 nm) Beer-Lambert law, Effect of solvent on electronic transitions, ultraviolet bands for carbonyl compounds, unsaturated carbonyl compounds, dienes, conjugated polyenes, Fieser Woodward rules for conjugated dienes and carbonyl compounds, ultraviolet spectra of aromatic compounds. Steric effect in biphenyls.

UNIT-II

Infrared Spectroscopy

Characteristic vibrational frequencies of alkanes, alkenes, alkynes, aromatic compounds, alcohols, ethers, phenols and amines. Detailed study of vibrational frequencies of carbonyl compounds (ketones, aldehydes, esters, amides, acids, anhydrides, lactones, lactams and conjugated carbonyl compounds). Effect of hydrogen bonding and solvent effect on vibrational frequencies, overtones, combination bands and fermi resonance.

UNIT-III

Nuclear Magnetic Resonance of Paramagnetic Substances in Solution

The contact and Pseudo contact shifts, factors affecting nuclear relaxation, some applications including biochemical systems, an overview of NMR of metal nuclide with emphasis on

^{195}Pt and ^{119}Sn NMR.

UNIT-IV

Carbon-13 NMR Spectroscopy

General considerations, chemical shift (aliphatic olefinic, alkyne, aromatic, heteroaromatic and carboynl carbon), coupling constants. Two dimension NMR spectroscopy-COSY, NOESY, DEPT, HMBC and HMQC techniques.

UNIT-V

Mass Spectrometry

Introduction ion production E1, C1 FD, ESI and FAB, factors affecting fragmentation, ion analysis, ion abundance Mass spectral fragmentation of organic compounds, common functional groups, molecular ion

peak, metastable peak. Me Lafferty rearrangement. Nitrogen rule. High resolution mass spectrometry. Structure elucidation of simple molecules using UV – Visible, IR, NMR and mass spectral techniques.

Suggested Readings:

1. Physical Methods for Chemistry, R.S. Drago, Saunders Compnay.

2. Structural Methods in Inorganic Chemistry, E.A.V. Ebsworth, D.W.H. Rankin and S. Cradock, ELBS.

3. Infrared and Raman Spectral : Inorganic and Coordination Compounds K. Nakamoto, Wiley.

4. Progress in Inorganic Chemistry vol., 8, ed., F.A. Cotton, vol., 15 ed. S.J. Lippard, Wiley.

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SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Chemistry

CHE-402- SOLID STATE CHEMISTRY (Compulsory)

CHE402	**SOLID STATE CHEMISTRY (Compulsory)**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

UNIT-I

Solid State Reactions

General principles, experimental procedure, co-precipitation as a precursory to solid state reactions, kinetics of solid state reactions.

UNIT-II

Crystal Defects and Non-Stoichiometry

Perfect and imperfect crystals, intrinsic and extrinsic defects-point defects, line and plane defects, vacancies-Schottky detects and Frenkel defects. Thermodynamics of Schottky and Frenkel defect formation, colourcentres, non-stoichiometry and defects.

UNIT-III

Electronic Properties and Band Theory

Metals insulators and semiconductors, electronic structure of solidsband theory band structure of metals, insulators and semiconductors, Intrinsic and extrinsic semiconductors, doping semiconductors, p-n junctions, super conductors. Optical properties-Application of optical and electron microscopy. Magnetic Properties-Classification of materials : Effect of temperature calculation of magnetic moment, mechanism of ferro and anti ferromagnetic ordering super exchange.

UNIT-IV

Organic Solids

Electrically conducting solids. organic charge transfer complex, organic metals, new superconductors.

UNIT-V

Liquid Crystals:

Types of liquid crystals: Nematic, Smectic, Ferroelectric, Antiferroelectric, Various theories of LC, Liquid crystal display, New materials.

Suggested Readings:

1. Solid state chemistry and its applications, A.R. West. Peenum.

2. Principles of the Solid State, H.V. Keer, Wiley Eastern.

3. Solid State Chemistry, N.B. Hannay.

4. Solid State Chemistry, D.K. Chakrabarty, New Wiley Eastern.

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SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Chemistry

CHE403	BIOCHEMISTRY (Compulsory)	3L:0T:1P	36 Hrs	3Hrs/Week

UNIT-I

Metal Ions in Biological Systems

Bulk and trace metals with special reference to Na, K, Mg, Ca, Fe, Cu, Zn, Co, and K+/Na+ pump. **Bioenergetics and ATP Cycle.**

DNA polymerisation, glucose storage, metal complexes in transmission of energy; chlorophyll's,

photosystem I and photosystem II in cleavage of water.

Transport and Storage of Dioxygen Heam proteins and oxygen uptake structure and function of haemoglobin's, mygolobin, haemocyanms and hemerythrin, model synthetic complexes of iron, cobalt and copper.

UNIT-II

Electron Transfer in Biology

Structure and function of metal of proteins in electron transport processes cytochrome's and ion-sulphure proteins, synthetic models. **Nitrogen fixation** Biological nitrogen fixation, and its mechanism, nitrogenase, Chemical nitrogen fixation.

UNIT-III

Enzymes : Introduction and historical perspective, chemical and biological catalysis, remarkable properties of enzymes like catalytic power, specificity and regulation. Nomenclature and classification, extraction and purification. Fischer's lock and key and Koshalnd's induced fit hypothesis, concept and identification of active site by the use of inhibitors, affinity labeling and enzyme modification by site-directed mutagenesis. Enzyme kinetics, Michael's-Menten and Lineweaver Burk plots, reversible and irreversible inhibition.

Mechanism of Enzyme Action Transition-state theory, orientation and Steric effect, acid-base catalysis, covalent catalysis, strain or distortion. Examples of some typical enzyme mechanisms for chemotrypsin, ribonuclease, lysozyme and carboxypeptidase.

Kinds of Reactions Catalysed by Enzymes Nucleophilic displacement on a phosphorus atom, multiple displacement reactions and the coupling of ATP cleavage to endergonic processes. Transfer of sulphate, addition and elimination reactions, enolic intermediates in Isomerisations reactions, b-Cleavage and condensation, some isomerization and rearrangement reactions. Enzyme catalyzed carboxylation and decarboxylation.

UNIT-IV

Co-Enzyme Chemistry

Cofactors as derived from vitamines, coenzymes, prosthetic groups, apoenzymes. Structure and biological functions of coenzyme A, thiamine pyrophosphate, pyridoxal phosphate, NAD+, NADP+, FMN, FAD, lipoic acid, vitamin B12. Mechanisms of reactions catalyzed by the above cofactors.

Enzyme Models

Host-guest chemistry, chiral recognition and catalysis, molecular recognition, molecular asymmetry and prochirality Biometric chemistry, crown ether, cryptates. Cyclodextrins, cyclodextrion-based enzyme models, clixarenes, ionospheres, micelles synthetic enzymes or synzymes.

Biotechnological Applications of Enzymes

large-scale prodcution and purification of enzymes, techniques and methods of immobilization of

enzymes, effect of immobilization on enzyme activity, application of immobilized enzymes, use of enzymes in food and drink industry-brewing and cheese-making, syrups from cron starch, enzymes as targets for drug design. Clinical uses of enzymes, enzyme therapy, enzymes and recombinant DNA Technology.

UNIT-V

Biological Cell and its Constituents

Biological cell, structure and functions of proteins, enzymes, DNA and RNA in living systems. Helix coils transition.

Bioenergetics Standard free energy change in biochemical reactions, exergonic, endergonic. Hydrolysis of ATP, synthesis of ATP from ADP.

Biopolymer Interactions Forces involved in biopolymer interactions. Electrostatic charges and molecular expansion, hydrophobic forces, dispersion force interactions. Multiple equilibrium and various types of bidning processes in biological systems. Hydrogen ion titration curves.

Cell Membrane and Transport of Ions

Structure and functions of cell membrane, ion transport through cell membrane, irreversible

thermodynamic treatment of membrane transport. Nerve conduction.

Suggested Readings:

1. Principles of Bioinorganic Chemistry, S.J. Lippard and J.M. Berg, University Science Books.

2. Bioinorganic Chemistry, 1. Bertini, H.B. Gray, S.J. Lippard and J.S. Valentine, University Science Books.

3. Inorganic biochemistry vol. I and II ed. G.L. Eichhorn, Elsever.

4. Progress in Inorganic Chemistry, Vol 18 and 38 ed J.J. Lippard, Wiley.

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SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Chemistry

MEDICINAL CHEMISTRY (OPTIONAL)

CHE404 (A)

CHE404 (A)	**MEDICINAL CHEMISTRY (OPTIONAL)**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

UNIT-I

Structure and activity : Relationship between chemical structure and biological activity (SAR). Receptor Site Theory. Approaches to drug design. Introduction to combinatorial synthesis in drug discovery. Factors affecting bioactivity. QSAR-Free-Wilson analysis, Hansch analysis, relationship between Free Wilson analysis and Hansch analysis.

UNIT-II

Pharmacodynamics:

Introduction, elementary treatment of enzymes stimulation, enzyme inhibition, sulfonamides, membrane active drugs, drug metabolism, xenobiotics, biotransformation, significance of drug metabolism in medicinal chemistry.

UNIT-III

Antibiotics and antibacterials

Introduction, Antibiotic β-Lactam type - Penicillins, Cephalosporins, Antitubercular – Streptomycin, Broad spectrum antibiotics – Tetracyclines, Anticancer - Dactinomycin (Actinomycin D)

UNIT-IV

Antifungal –

polyenes, Antibacterial – Ciprofloxacin, Norfloxacin, Antiviral – Acyclovir

Antimalarials:Chemotherapy of malaria. SAR. Chloroquine, Chloroguanide and Mefloquine

UNIT-V

Non-steroidal Anti-inflammatory Drugs : Diclofenac Sodium, Ibuprofen and Netopam

Antihistaminic and antiasthmatic agents :

Suggested Readings:

1. Introduction to medicinal chemistry, A. Gringuage, Wiley-VCH.

2. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, Ed Robert F Dorge.

3. An Introduction to Drug Design, S.S. Pandeya and J.R. Dimmock, New Age Internaitonal.

CHE-404 (B)	ELECTROCHEMISTRY	3L:0T:1P	36 Hrs	3Hrs/Week

UNIT-I

1. Conversion and Storage of Electrochemical Energy Present status of energy consumption :

Pollution problem. History of fuel cells, Direct energy conversion by electrochemical means. Maximum intrinsic efficiency of an electrochemical converter. Physical interpretation of the Carnot efficiency factor in electrochemical energy converters. Power outputs. electrochemical Generators (Fuel Cells) : Hydrogen oxygen cells, Hydrogen Air cell, Hydrocarbon air cell, Alkane fuel cell, Phosphoric and fuel cell, direct NaOH fuel cells, applications of fuel cells.

2. Electrochemical Energy Storage :

Properties of Electrochemical energy storage : Measure of battery performance, Charging and discharging of a battery, Storage Density, Energy Density. Classical Batteries : (i) Lead Acid (ii) Nickel-Cadmium, (iii) Zinc manganese dioxide. Modern Batteries : (i) Zinc-Air (ii) Nickel-Metal Hydride, (iii) Lithium Battery, Future Electricity storers : Storage in (i) Hydrogen, (ii) Alkali Metals, (iii) Non aqueous solutions.

UNIT-II

Corrosion and Stability of Metals :

Civilization and Surface mechanism of the corrosion of the metals; Thermodynamics and the stability of metals, Potential -pH (or Pourbaix) Diaphragmsl; uses and abuses, Corrosion current and corrosion potential -Evans diagrams. Measurement of corrosion rate : (i0 Weight Loss method, (ii) Electrochemical Method.

Inhibiting Corrosion :

Cathodic and Anodic Protection. (i) Inhibition by addition of substrates to the electrolyte environment, (ii) by charging the corroding method from external source, anodic Protection, Organic inhibitors, The fuller Story Green inhibitors.

Passivation :

Structure of Passivation films, Mechanism of Passivation, Spontaneous Passivation Nature's method for stabilizing surfaces.

UNIT-III

Bioelectrochemistry :

bioelectrodics, Membrane Potentials, Simplistic theory, Modern theory, Electrical conductance in biological organism: Electronic, Protonic electrochemical mechanism of nervous systems, enzymes as electrodes.

Kinetic of Electrode Process :

Essentials of Electrode reaction. Current Density, Overpotential, Tafel Equation, Butler Volmer equation. Standard rate constant (K0) and Transfer coefficient (a), Exchange Current.
Irreversible Electrode processes : Criteria of irreversibility, informatino from irreversible wave.

UNIT-IV

Methods of determining kinetic parameters for quasi-rversible and irreversible waves : Koutecky's methods, Meits Israel Method, Gellings method

Electrocatalysis :

Chemical catalysts and Electrochemical catalysts with special reference to purostates, porphyrin oxides of rare earths. Electrocatalysis in simple redox reactions, in reaction involving adsorbed species. Influence of various parameters.

UNIT-V

Potential Sweep Method :

Linear sweep Voltammetry, Cyclic Voltammetry, theory and applications. Diagnostic criteria of cycli voltammetry. Controlled current microelectrode techniques : comparison with controlled potentials methods, chronopotentiometry, theory ad applications.

Bulk Electrolysis Methods :

Controlled potential coulometry, Controlled Coulometry, Electroorganic synthesis and its important applications. Stripping analysis : anodic and Cathodic modes, Pre electrolysis and Stripping steps, applications of Stripping Analysis.

SUGGESTIED READINGS:

1. Polarographic Techniques by L. Meites, Interscience.

2. "Fuel Cells : Thjeir electrochemistry". McGraw Hill Book Company, New York.

3. Modern Polarographic Methods by A.M. Bond, Marcell Dekker.

4. Polarography and allied techniques by K. Zutshi, New age International publicatin. New Delhi.

UTD

SRI SATYA SAI UNIVERSITY OF TECHNOLOGY AND MEDICAL SCIENCES

Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Chemistry

INDUTSTRIAL CHEMISTRY - PESTICIDES & GLASS INDUSTRIES (OPTIONAL)

CHE405 (A)

CHE405 (A)	**INDUTSTRIAL CHEMISTRY - PESTICIDES & GLASS INDUSTRIES (OPTIONAL)**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

UNIT-I

Cleansing Agents

Cleansing Agents : Toilet and washing soaps; preparation and uses, Synthetic detergents; alkyl aryl sulfonates, fatty alcohot surfaces, ethanolamines, nonionic detergents.

UNIT-II

Fertizilizers and Inorganic Materials :

Fertilizers : Fertilizers Industries in India, Manufacture of Ammonium salts. Urea, Nitrates, Phosphates and Supephosphates, Nitrogen fixation.

Glass: Types, their composition and properties testing glass. Manufacture of Glass Fibres.Optical Glass, Coloured Glasses, Lead Glass and Neutron Absorbing Glass.

Ceramics: Important clays and feldspar. Glazing and vitrification, Glass ceramics.

UNIT-III

Cement : Types and their manufacture, setting process.

Ferrous Industry: Manufacture of steel and other important alloys.

Silicon : Pre silicon, Electronics Industry.

UNIT-IV

Pesticies and Food additives

Pesticies and Food additives : Classification, important categories of insecticides, fungicides, herbicides and rodenticies; Mode of action.

UNIT-V

Chemistry and synthesis of common pesticides : Such and Tabun, Sarin, Daygon, DDYP paraquat.

Suggested Readings:

Industrial Chemistry J.S Jangwan, A. S Mathuria

UTD

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Outcome based Curriculum for

Postgraduate Degree Courses in MSc -Chemistry

CHEMISTRY OF NATURAL PRODUCTS

CHE-405 (B)

CHE-405 (B)	**CHEMISTRY OF NATURAL PRODUCTS**	**3L:0T:1P**	**36 Hrs**	**3Hrs/Week**

UNIT-I **6 Hrs.**

Terpenoids and Carotenoids

Calsifications, nomenclature, occurrence, isolation, general methods of structure determination, isoprene rule. Structure determination, stereochemistry, biosynthesis and synthesis of the following representative molecules : Citral, Geraniol -Terpeneol, Menthol, Farnesol, Zingiberene, Santonin, Phytol, Abietic acid and -Carotene.

UNIT-II **6 Hrs.**

Alkaloids

Definition, nomenclature and physiological action, occurrence, isolation, general methods of structure elucidation, degradation, classification based on nitrogen heterocyclic ring, role of alkaloids in plants. Structure, stereochemistry, synthesis and biosynthesis of the following : Ephedrine , (+)- Coniine, Nicotine, Atropine, Quinine and Morphine.

UNIT-III **6 Hrs.**

Steroids

Occurrence, nomenclature, basic skeleton, Diel's hydrocarbon and stereochemistry, Isolation, Structure determination and synthesis of Cholesterol, Bile acids, Androsterone, Testosterone, Estrone, Progesterone, Aldosterone, Biosynthesis of Steroids.

UNIT-IV **6 Hrs.**

Plant Pigments

Occurrence, nomenclature and general methods of structure determination. Isolation and synthesis of Apigenin, Luteolin Quercetin, Myrcetin, Quercetin 3-glucoside, Vitexin, Diadzein, Aureusin, Cyanidin- 7arabinoside, Cyanidin, Hirsutidin, Biosynthesis of flavonoids: Acetate pathway and Shikimic acid pathway. **Prophyrins**

Structure and synthesis of Haemoglobin and Chlorophyll.

UNIT-V **6 Hrs.**

Prostaglandin

Occurrence, nomenclature, classification, biogenesis and physiological effects. Synthesis of PGE2 and PGF2a. **Pyrethroids and Rotenones**

Synthesis and reactions of Pyrethroids and Rotenones. (For structure elucidation, emphasis is to be placed on the use of spectral parameters wherever possible).

SUGGESTED READINGS:

1. Introduction to Flavonoids, B.A. Bohm. Harwood Academic Publishers.

2. New Trends in Natural Product chemistry, Ataaur Rahman and M.L. Choudhary, Harwood

Academic Publishers.

3. Rodd's Chemistry of Carbon Compounds, Ed. S. Coffey, Elsevier.

4. Chemistry, Biological and Pharmacological Properties of Medicinal Plants from the Americas, Ed. Kurt Hostettmann, M.P. Gupta and A. Marston. harwood Academic Publishers.

PRACTICALS

MB: 405- Lab-I

1. To study viral diseases in plants.
2. To study bacterial and fungal diseases in plants.
3. Isolation of rhizobia from root nodules of leguminous plants.

4. Testing of nodulation ability of rhizobia.
5. Inoculation of seeds with rhizobia.
6. To study pesticidal activity of *Bacillus thuringiensis*.
7. Isolation of VAM spores from soil.
8. Isolation of *Azotobacter* species from soil.
9. Isolation of microorganisms from rhizosphere.

MB: 406 Lab II

1. Detection of adulterants in spices, pulses, sugar, tea.
2. Detection of adulterants in milk and milk products.
3. Detection of arsenic by microbiological methods.
4. Detection of nicotinic acid by bioassay.
5. Detection of number of bacteria in milk by SPC.
6. Determination of quality of milk sample by methylene blue reductase test.
7. To demonstrate role of yeast in bread-making.
8. Isolation of microorganisms from spoiled food.
9. Isolation of pathogenic microorganisms from food.