MANONMANIAM SUNDARANAR UNIVERSITY, TIRUNELVELI

DEPARTMENT OF CHEMISTRY

M.Sc. CHEMISTRY Integrated program (CBCS) (3 + 2 = 5 years)

PROGRAM STRUCTURE & SYLLABUS

For those whose joined foe the academic year 2022-2023

1. Vision & Mission of the University

Vision

1. To provide quality education to reach the un-reached

Mission

1. To conduct research, teaching and outreach programmes to improve conditions of human living.
2. To create an academic environment that honors women and men of all races, caste, creed, cultures, and an atmosphere that values intellectual curiosity, pursuit of knowledge, academic freedom and integrity.
3. To offer a wide variety of off-campus educational and training programs, including the use of information technology, to individuals and groups.
4. To develop partnership with industries and government so as to improve the quality of the workplace and to serve as catalyst for economic and cultural development.
5. To provide quality / inclusive education, especially for the rural and un-reached segments of economically downtrodden students including women, socially oppressed and differently abled.

2. Vision of the department

Vision

To develop a Centre of Excellence for teaching as well a research at par with national and international standards. Reach a position of distinction by offering first-class education and serving the community in relevant areas of interest to the rural areas.

Mission

- Provide an educational environment where students can realize their full potential in chemistry and attain quality education to face the challenges of the future.

- Provide a dynamic, challenging and ethical environment for pursuing high-quality teaching, learning, research and service.

3. Course Objectives

- To impart theoretical and practical skills that underpins the various branches of the science of Chemistry
- To enable the students to have a thorough understanding and knowledge of different branches of Chemistry
- To make the students to develop the ability to think analytically and solve problems.
- To apply the skills and knowledge gained through the subject to real life situations and face competitive examinations with confidence.

4. Program Outcome

PO1 Observe the impact of chemistry to solve problems in environmental (societal) context

PO2 Understand the concepts involved in all branches of chemistry

PO3 Learn the basic principle/laws/ reactions in chemistry

PO3 Acquired basic laboratory skills from chemistry experiments

PO4 Identify and analyze the chemistry-oriented problems

PO5 Apply the knowledge of chemistry to solve scientific problems

PO6 To equip basic analytical and spectral methods

PO7 Proficiency in laboratory techniques for chemical industry-oriented jobs

PO8 Skilled up for water treatment, food analysis, pharmaceutical and quality control

PO9 Trained to execute the experiments and projects in various fields of chemistry

PO10 Cultivate a constant leaning, moral values and professional ethics for our society

5. Program specific outcome

PS01: Chemistry graduates will be nurtured with the qualities of experimental and research analysis, constant leaning moral values and professional ethics.

PS02: Chemistry graduates will be prepared to contribute in the areas of research conservation of environment, water treatment, food analysis, pharmaceutical analysis and quality control.

PS03: Chemistry graduates will be able to design, execute experiment/ projects and as team to give solutions to day today life problems for the benefit of the society.

6. Eligibility for Admission

The minimum eligibility conditions for admission to the M.**Sc., INTEGRATED Program in Chemistry** are given below.

The candidates for admission in the first semester of the Program will be required to have qualified the Higher Secondary Examination with 60 % marks (5 % relaxation for SC, ST and physically challenged candidates) in the following Science subject groups:

1. Mathematics, Physics, Chemistry + any other subject
2. Physics, Chemistry, Botany/Zoology + any other subject

or any other Examination as equivalent thereto in science subject. In addition, the candidate has to qualify the Entrance test conducted for admission into this program.

Admission will be based on (i) the total marks obtained in the qualifying Higher Secondary examination (Chemistry paper only).

7. Duration of the Course

The students shall undergo the prescribed course of study for a period not less than **five** academic years (Ten semesters) consisting of 6 semesters (I – VI) for studying fundamentals of Chemistry (similar to Undergraduate Chemistry) and 4 semesters (VII – X) for studying advanced Chemistry (similar to Post-graduate Chemistry).

8. Internal Assessment

Distribution of marks between External and Internal Assessment is

- For Theory = 75: 25
- For Practical = 50 :50

Pass minimum of 50% for external and overall components.

Internal Marks for Theory shall be allotted in the following

The average of the best two from three compulsory tests.	15 Marks
Assignment	05 Marks
Seminar	05 Marks
TOTAL	**25 Marks**

Internal Marks for Practical shall be allotted in the following manner

Lab performance	25 Marks
Internal Test (Average of two test)	25 Marks
TOTAL	**50 Marks**

9. Question Pattern

Scheme of Examination and question pattern

The question distribution as (Understand-35%, Apply-25%, Analyze-15%, Evaluate-15%, Create-10%).

Time: 3 hours Max. marks:75

Part A	:	10 questions full of Objective type WITHOUT multiple choice. Two questions from each unit of a paper. Each question carries one mark	10 x 1=10 marks
Part B	:	5 descriptive questions, of either a or b type (internal choice). One question is from each unit. Each question carries 5 marks	5 x 5 = 25 marks
Part C	:	5 descriptive questions of either a or b type (internal choice). One question is from each unit. Each question carries 8 marks.	5 x 8 = 40 marks

Course Weight: In each of the courses, credits will be assigned on the basis of the lectures / tutorials / lab work and other forms of learning in a 15-week schedule.

1. One credit for each lecture hr. per week
2. One credit for each tutorial hr. per week
3. One credit for every two hrs. of Lab or Practical Work per week

Internship

Internship for VI semester shall be an GROUP project. Project evaluation will be done by Guide and another faculty member of the department. Viva voce Examination for the project students will be conducted jointly by the same examiners who evaluated the project report.

Course Structure of M.Sc Integrated Chemistry Program

The credit and teaching norms of the program is distributed as under.

Program Structure (For I - VI Semesters)

SEM	Sub No.	Subject Status	Subject code	Subject Title	T. Hrs/Week	P Hrs./Week	Credits
I	1	Language	H1TL11	Tamil / other Language	4	-	4
	2	Language	H2EN11	English	4	-	4
	3	Core	HCHC11	Organic Chemistry I	4	-	4
	4	Core	HCHC12	Inorganic chemistry I	4	-	4
	5	Major Practical -I	HCHL11	Inorganic practical I	-	4	2
	6	Allied – I			3	-	3
	7	Allied Practical - I			-	4	2
	8	Common	HEVS11	Environmental Studies	2	-	2
				Subtotal	**29**		**25**
II	9	Language	H1TL21	Tamil / other Language	4	-	4
	10	Language	H2EN21	English	4	-	4
	11	Core	HCHC21	Inorganic Chemistry II	4	-	4
	12	Core	HCHC22	Physical Chemistry I	4	-	4
	13	Major Practical -II	HCHL21	Inorganic practical II	-	4	2
	14	Allied – II			3	-	3

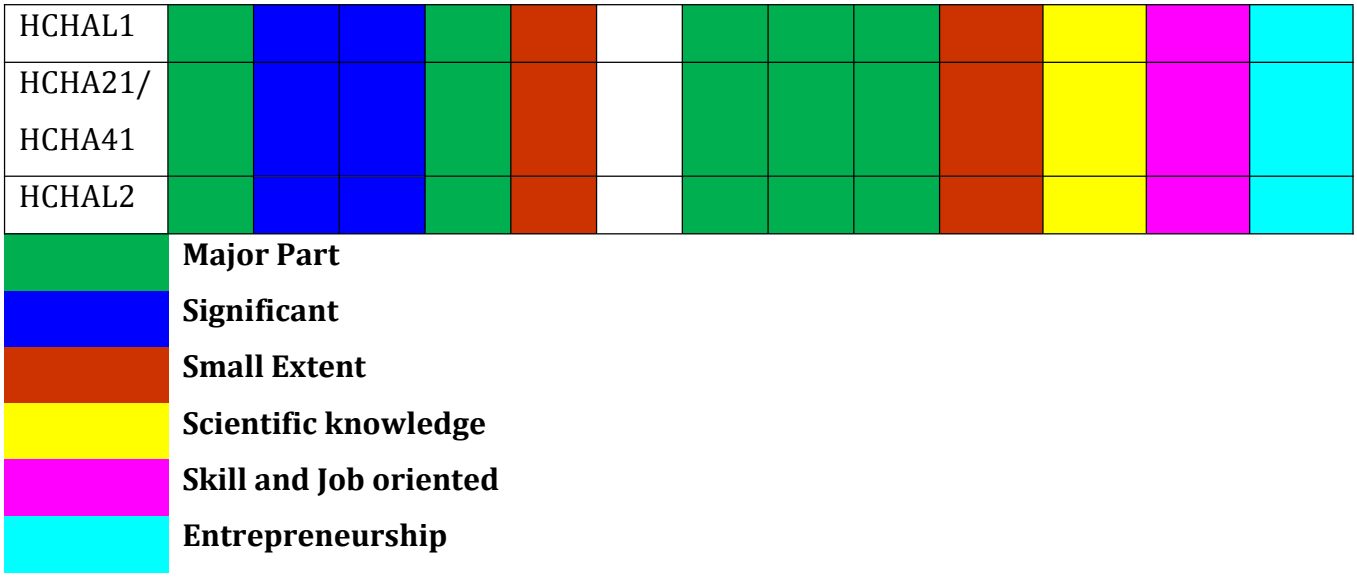
	15	Allied Practical – II			-	4	2
	16	Common	HVBE21	Value Based Education/Social Harmony	2	-	2
				Subtotal	**29**		**25**
III	17	Language	H1TL31	Tamil / other Language	4	-	4
	18	Language	H2EN31	English	4	-	4
	19	Core	HCHC31	Physical Chemistry II	4	-	4
	20	Major Practical -I	HCHL31	Organic practical I	4	-	4
	21	Allied – I			-	4	2
	22	Allied Practical - I			3	-	3
	23	Non Major Elective	HCHNE1 / HCHNE2	Food chemistry/Water management	-	4	2
	24	Common	HYOG31	Yoga	2	-	2
				Subtotal	**29**		**25**
IV	25	Language	H1TL41	Tamil / other Language	4	-	4
	26	Language	H2EN41	English	4	-	4
	27	Core	HCHC41	Organic Chemistry II	4	-	4
	28	Major Practical -II	HCHL41	Organic Practical II	4	-	4
	29	Allied – II			-	4	2
	30	Allied Practical - II			3	-	3
	31	Non Major Elective	HCHNE3 / HCHNE4	Applied Chemistry/Clinical Chemistry	-	4	2
	32	Common	HCDE41	Computer for Digital Era	2	-	2

	33	Extension Activity	HEXA41	NCC, NSS, YRC, YWF	2	-	1
				Subtotal	**30**		**25**
V	34	Core	HCHC51	Organic III	4	-	4
	35	Core	HCHC52	Inorganic III	4	-	4
	36	Core	HCHC53	Physical III	4	-	4
	37	Skill Based Core - I	HCHSC1/HCHSC2	Food Chemistry/Agro Chemistry	4	-	4
	38	Major Elective –I	HCHEA /HCHEB	Analytical/Pharmaceutical Chemistry	4	-	4
	39	Major Practical - V	HCHL51	Physical practical I	-	4	2
	40	Major Practical - V	HCHL52	Physical practical II		4	2
	41	Skill Based Common	HSBC51	Personality Development/Effective Communication/Youth Leadership	2	-	2
				Subtotal	**28**		**26**
VI	42	Major Elective – II	HCHEC /HCHED	Polymer/Industrial Chemistry (online mode)	4	-	4
	43	Skill Based Core - II	HCHSC3 / HCHSC4	Chromatography/ Dairy Chemistry (online mode)	4	-	4
	44	Internship	HCHI61	Internship	-		27
				Subtotal	**8**		**35**
				Grant Total	**173**		**160**

For Semesters VII to X, the Structure of Program and syllabus shall be the one followed for TWO YEAR M.Sc Chemistry program CBCS offered in Department of Chemistry

Mapping -PO-PSO

Course Code	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PSO1	PSO2	PSO3
HCHC11													
HCHC12													
HCHL11													
HCHC21													
HCHC22													
HCHL21													
HCHC31													
HCHL31													
HCHNE1													
HCHNE2													
HCHC41													
HCHL41													
HCHNE3													
HCHNE4													
HCHC51													
HCHC52													
HCHC53													
HCHSC1													
HCHSC2													
HCHEA													
HCHEB													
HCHL51													
HCHL52													
HCHSC3													
HCHSC4													
HCHEC													
HCHED													
HCHA11/ HCHA31													


HCHAL1
HCHA21/
HCHA41
HCHAL2
Major Part
Significant
Small Extent
Scientific knowledge
Skill and Job oriented
Entrepreneurship

SEMESTER I

ORGANIC CHEMISTRY– I

Course code - HCHC11		
Credits	**Hours**	**Course**
4	**60**	**Core**

Course Objectives

1. To study about polar effects and reaction intermediates
2. To learn the mechanism of substitution and elimination reactions.
3. To study the conformations of hydrocarbons.
4. To learn the chemistry of halide and oxygen based functional organic compounds.
5. To learn the preparation and uses of organometallic compounds.

Course Prerequisites

1. Students must study chemistry as one of the subjects in higher secondary level.

Course Outcomes

At the end of the course the student will be able to

1. Know the basic concept of Organic reaction mechanism.
2. Understand the mechanism of addition, elimination and substitution reaction.
3. Acquire knowledge about synthesis, mechanism and uses of substituted hydrocarbons.
4. Point out the nature and uses of organometallic and hetero-organic compounds.

Unit I Principles of reaction (12hrs.)

Polar effects-inductive, resonance and steric effects and their influence on acidity and basicity of organic compounds – pπ-dπ bonds, Heterolytic and homolytic cleavage, nucleophiles and electrophiles-reaction intermediates – preparation, properties and structures of carbonium ions, carbanions and free radicals -type of reactions - substitution, addition, elimination and polymerisation reactions.

Unit II Hydrocarbons (12hrs.)

Classification of alkadienes, stability of conjugate dienes- Mechanism of 1,2 and 1,4-addition- Diels-Alder reaction. Acidity of alkynes and formation of metal acetylides. Addition to unsymmetrical olefins (Markownikoff's rule and peroxide effect), hydroboration, ozonolysis, dihydroxylation with $KMnO_4$, OsO_4& allylic bromination by NBS (mechanisms not required) Brominating reagents – Br_2, $NaBrO_3$.

Unit III Halogen derivatives (12hrs.)

S_N1 and S_N2 mechanisms - E_1 and E_2 mechanisms- Hoffmann's and Saytzeffs rule- preparation, properties and uses of chloroform, carbon tetrachloride, vinyl chloride and allyl chloride- preparation and uses of westron, westrosol, freon and chloroprene.

Unit IV Alcohols and ethers (12hrs.)

Distinction between primary, secondary and tertiary alcohols – nitroglycerol, dynamite- estimation of hydroxyl groups- mechanism of dehydration of alcohols- preparation and properties of allyl and crotyl alcohol.

Preparation and uses of oxirane and dioxan –Estimation of number of methoxy groups-Zeisel's method.Distinction between ethers and alcohols.

Unit V Organometallic compounds and organosulphur compounds (12hrs.)

Preparation, structure and synthetic uses of Grignard reagent-preparation and reactions of methyl lithium, diethyl zinc, tetraethyl lead and tetramethyltin- Reformatsky reaction - Preparation and properties of thioalcohols and thioethers – sulphonal-mustard gas and sulphones.

References

1. K. S. Tewari and N. K. Vishnoi, A Text Book of Organic Chemistry, Vikas Publishing House Pvt Ltd, 2006.
2. Arun Bahl and B.S. Bahl, Advanced Organic Chemistry, S. Chand and Sons, 2012.
3. M.K. Jain and S. C. Sharma, Modern Organic Chemistry, Visal Publishing Co, 2015.
4. N. Tewari, Advanced Organic Reaction Mechanism, Third Edition 2011, Books & Allied (P) Ltd.
5. L. Finar, Organic Chemistry Volume I, ELBS, Longmans,2011.

COURSE OUTCOME MAPPING

	UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5
CO1	L3	L2	L2	L1	
CO2	L2	L3	L3	L2	L1
CO3	L1	L2	L3	L3	L1
CO4		L1	L1	L1	L3

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

INORGANIC CHEMISTRY– I

Course code - HCHC12		
Credits	**Hours**	**Course**
4	**60**	**Core**

Course Objectives

1. To understand the fundamentals of atomic structure, quantum numbers and radial distributions.
2. To know the arrangement of elements in the periodic table and the periodicity in properties.
3. To know the bonding fundamentals for both ionic and covalent compounds, including electronegativities, bond distances and bond energies using MO diagrams and thermodynamic data
4. To distinguish chemical bonding from the valence bond model and molecular orbital theory
5. To study the nature of hydrides and chemistry of Li and Be compounds in the S block elements.

Course Prerequisites

1. Students must study chemistry as one of the subjects in higher secondary level.

Course Outcomes

At the end of the course the student will be able to

1. Visualize dual nature of matter and quantum mechanical wave concept
2. Generalize the position of elements and periodicity properties.
3. Apply electronegativity concept to analyze the chemical nature of the bond.
4. Analyze covalent character in ionic compounds.
5. Predict geometries, bond angle, bond order and magnetic property of simple molecules
6. Fashion and diagonal relationship of Li and Be compounds.

Unit I Atomic structure (12hrs.)

Dual nature of matter – de Broglie equation (verification not required) - Schrodinger wave equation and its applications (no derivation)- Eigen value and eigen function-significance of Ψ and Ψ^2 –quantum numbers and their significance-principles governing the occupancy of electrons in various quantum levels-Pauli's exclusion

principle-Hund's rule, Aufbau principle- probability distribution of electron around the nucleus –radial probability distribution

Unit II Periodic properties (10hrs.)

Long form of periodic table- classification as s, p, d and f block elements - periodicity in properties- variation of atomic and ionic radii, electron affinity, ionization energy and electronegativity along periods and groups – various scales of electronegativity – Pauling, Mullikan and Allred Rochow's scale of electronegativity – factors affecting the magnitude of electronegativity – applications of electronegativity

Unit III Chemical bonding-I (14 hrs)

Properties of ionic compounds- Lattice energy- definition- Born-Lande equation (derivation not required), factors affecting lattice energy, Born-Haber cycle-enthalpy of formation of ionic compound and stability. Covalent character in ionic compounds-polarization and Fajan'srule.

Unit IV Chemical bonding-II (10hrs.)

Valence bond theory – hybridization of atomic orbitals and geometry of molecules –sp, sp^2, sp^3, sp^3d and sp^3d^2hybridization with examples. VSEPR theory- shapes of simple inorganic molecules – MO theory- applications of MOT to O_2, F_2, HF and CO- comparison of VBT and MOT.

Unit V S-block elements (14hrs.)

Hydride (classification, general methods of preparation and salient features), hydration energies, solvation and complexation tendencies of alkali and alkaline-earth metals-Chemistry of Li and Be, their anomalous behavior and diagonal relationship - alkyls and aryls- roles of Li and Be in biology.

References

1. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, Shoban Lal Nagin Chand and Co., Delhi, 1996.
2. P. L. Soni, Text Book of Inorganic Chemistry, 20^{th} edition, 2001.

3. R. D Madan, Modern Inorganic Chemistry, S. Chand and company, 13th edition, 2005.
4. J. D. Lee, Concise Inorganic Chemistry, 5th ed., Blackwell Science, London, 1996.
5. F. A. Cotton, G. Wilkinson, C. Murillo and M. Bochman, Advanced Inorganic Chemistry, Wiley India, 6th edition, 2008.

COURSE OUTCOME MAPPING

	UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5
CO1	**L3**	**L3**	**L2**		
CO2		**L3**	**L2**		**L1**
CO3				**L3**	**L3**
CO4			**L1**	**L2**	**L3**
CO5				**L2**	**L3**
CO6	**L1**	**L1**	**L2**	**L2**	**L2**

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

INORGANIC PRACTICAL-I

Course code - HCHL12		
Credits	**Hours**	**Course**
2	**60**	**Practical**

Course Objectives

1. To enable the students to acquire the quantitative skills in volumetric analysis and
2. To understand the complexometric titration.
3. To acquire the qualitative skill in inorganic salt analysis.

Course Prerequisites

Students must study chemistry as one of the subjects in higher secondary level.

Course Outcomes

On the successful completion of this course, student will able to

1. Understand the concept of acidimetry and alkalimetry.
2. Justify the concept of semimicro analysis.
3. Qualitative and quantitative analysis of cations/anions.

I. ACIDIMETRY AND ALKALIMETRY

a. Estimation of oxalic acid

b. Estimation of Na_2CO3

c. Estimation of sodium oxalate

d. Estimation of ferrous ammonium sulphate

e. Estimation of copper

f. Estimation of ferrous iron

g. Estimation of $K_2Cr_2O_7$

h. Total hardness of water

II. SEMI MICRO QUALITATIVE ANALYSIS

Inorganic salt mixtures containing two acid radicals (one should be an interfering radical) and two basic radicals

Anions	Simple anions	Carbonate, nitrate, sulphate, chloride and bromide
	Interfering anions	Borate, fluoride, oxalate, phosphate and chromate
Cations	Group I	Lead
	Group II	Copper, Cadmium, Bismuth, Antimony
	Group III	Aluminium, Ferrous iron

	Group IV	Cobalt, Nickel, Manganese, Zinc
	Group V	Barium, Strontium, Calcium
	Group VI	Magnesium, Ammonium.

References

1. G.H.Jeffery, J.Bassett, J.Mendham and R.C.Denny 'Vogel's Text book of Quantitative Chemical Analaysis5th Edition,1978, ELBS.
2. I.M.Kolthoff and E.A.Sanderson, Quantitative Chemical Analysis, S Chand, O.P. Pandey, D.N Bajpai, S. Gini, Practical Chemistry, for I, II &III BSc, 1989.
3. Students. S.Chand & Company Ltd reprint 2009.
4. V.K.Ahluwalia, Sunitha Dhingra, Adarsh GulateCollege Practical Chemistry, Universities Press (India) Pvt. Ltd 2008 (reprint).

COURSE OUTCOME MAPPING

	Expt 1	**Expt 2**
CO1	**L3**	
CO2		**L3**
CO3	**L2**	**L2**

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

SEMESTER II

INORGANIC CHEMISTRY- II

Course code - HCHC21		
Credits	**Hours**	**Course**
4	**60**	**Core**

Course Objectives

1. To know the basic principles of metallurgy and the chemistry of d- Block elements
2. To learn the chemistry of f- Block elements
3. To learn the acid base concepts and the reactions in non-aqueous solvents
4. To understand the basic concepts of coordination chemistry and early theory
5. To learn the basic analytical methods

Course Prerequisites

1. Students must study chemistry as one of the subjects in higher secondary level.

Course Outcomes

1. Students will able to differentiate between various inorganic reactive intermediates.
2. Students can recognize classify, explain and apply fundamental inorganic reactions.
3. Develop abilities to understand how to estimate and analyze the group study of p & d block elements.
4. Learns the principles and techniques to understand structural and stereo isomerism in coordination complexes.
5. Develop abilities to characterize inorganic through understanding theories of acids and bases a solvent system.

Unit I p-block elements (12hrs.)

Comparative study (group-wise) of group 13 & 14 elements with respect to periodic properties. Compounds such as hydrides, halides, oxides and oxyacids-diagonal relationship-

preparation, properties, bonding and structure of diborane, borazine and alkali metal borohydrides. Preparation, properties and technical applications of carbides and fluorocarbons.Silicones and structure of silicates.

Unit II Metallurgy (12hrs.)

Occurrence of metals – concentration of ores – froth floatation, magnetic separation, calcinations, roasting and smelting. Purification of metals – electrolysis, zone refining, van Arkel de Boer methods.

Unit III d-Block elements (12hrs.)

General characteristics of d- Block elements – Group study of Titanium, Iron, Coinage and Zinc group metals. Important compounds of transition metals: Ziegler – Natta catalyst. Prussian blue, Sodium nitroprusside, Turnbull's blue, Nickel DMG complex, Wilkinson's Catalyst- $KMnO_4$ and $K_2Cr_2O_7$.

UNIT IV Coordination Chemistry-I (12hrs.)

Introduction: ligands- monodentate, bidentate, and polydentate ligands; coordination sphere; Coordination number; nomenclature of mononuclear and dinuclear complexes. Structural and stereoisomerism in tetrahedral, square planar and octahedral complexes.

Valance Bond theory – applications of valance bond theory to tetrahedral, square planar and octahedral complexes- Merits and limitations of VB theory

Unit V Acids, Bases and Non-aqueous solvents (12hrs.)

Acids and Bases: Arrhenius theory, acids and bases in protic solvents, Bronsted-Lowry theory, Lewis theory, the solvent system, Lux-Flood definition, Usanovich definition; hard and soft acids and bases-HSAB principle.

Non-aqueous solvents: physical properties of a solvent, types of solvents and their general characteristics. Reactions in non - aqueous solvents with reference to liq. NH_3 and liq SO_2- Comparison.

References

1. Puri B.R., Sharma L.R., Kalia K.K., Principls of Inorganic Chemistry, 28th edition, Vallabh Publication, 2004, New Delhi.
2. R.D. Madan, Advanced Inorganic Chemistry, 2nd edition.S. Chand & Company, 2005, New Delhi.

3. Concise coordination chemistry – R. Gopalan, V. Ramalingam, Vikas publishing House, Pvt. Ltd, 2001, New Delhi.
4. J.D.Lee, Concise Inorganic Chemistry, 5th edition , Oxford University Press, New Delhi 2008.
5. G.H. Jeffery, J. Bassett, J. Mendham, R.C. Denny, Vogel's Text book of Quantitative Chemical Analysis, 5th Edn., ELBS, 1989.
6. D.A.Skoog and D.M.West, Fundamentals of Analytical Chemistry, Holler Saunders College publishing, USA.VI Ed., 1998.

COURSE OUTCOME MAPPING

	UNIT 1	**UNIT 2**	**UNIT 3**	**UNIT 4**	**UNIT 5**
CO1	**L3**	**L3**	**L2**		
CO2		**L3**	**L2**		**L1**
CO3				**L3**	**L3**
CO4			**L1**	**L2**	**L3**
CO5				**L2**	**L3**
CO6	**L1**	**L1**	**L2**	**L2**	**L2**

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

PHYSICAL CHEMISTRY-I

Course code - HCHC22		
Credits	**Hours**	**Course**
4	**60**	**Core**

Course Objectives

1. To study the behavior of molecules in gaseous states.
2. To acquire the knowledge about solid state and crystal structure.
3. To understant the basic aspects of nuclear chemistry and its applictions.
4. To realize the various phenomena on the surface of solids and enhance the applications of surface chemistry in studying enzyme mechanisms.
5. To recongnize the chemical kinetics; how reaction rates are measured and represented in rate laws, and various theories of reaction rates.

Course Prerequisites

1. Students must study chemistry as one of the subject in higher secondary level.

Course Outcomes

At the end of the course the student will be able to

1. Remember the basic concepts of gaseous stat and chemical kinetics.
2. Understand the fundamental laws in solid state and surface chemistry
3. Apply the principles involved in determination of molecular mass, energy, rate constant
4. Evaluate the various physical parameters using the mentioned concepts.
5. Adopt the methods and techniques studies for a chemical reaction

.

Unit I Gaseous state (12hrs.)

Types of molecular velocities and their inter relations - mean, rms, most probable velocities - Calculation of most probable velocity, average velocity and root mean square velocity Maxwell's distribution of molecular velocities, statement of equation and explanation (no derivation) – graphic representation - effect of temperature on velocity distribution. Collision diameter - collision number - collision freqeuency - mean free path – Degrees of freedom of gaseous molecules - principle of equipartition of energy - heat capacity and molecular basis. Viscosity of gases and effect of temperature and pressure on coefficient of viscosity

Unit II Solid state (12hrs.)

Difference between crystalline and amorphous solids - isotropy and anisotropy - crystal lattices - laws of crystallography - elements of symmetry of crystals - crystal systems - unit cell - space lattice - Bravais lattices - Miller indices - cubic and hexagonal packing – radius ratio rule – tetrahedral and octahedral voids

Bragg's equation, derivation and applications - determination of structure of crystals by X-ray diffraction methods - rotating crystal and powder method, structure of NaCl, KCl and ZnS. Imperfections in a crystal - Schottky defects, Frenkel defects, Nonstoichiometric defects - use of crystallographic data for the determination of Avogadro number and molecular mass

Unit III Surface chemistry (12hrs.)

Adsorption - physisorption and chemisorptions - adsorption of gases by solids - adsorption isotherms - Freundlich adsorption isotherm - derivation of Langmuir adsorption isotherm, statement and explanation of BET isotherm - applications of adsorption - determination of surface area – adsorption indicators.

General characteristics of catalytic reactions – phase transfer catalysis - acid base catalysis - enzyme catalysis - mechanism and kinetics of enzyme catalyzed reactions – Michaelis-Menten equation

Unit IV Nuclear chemistry (12hrs.)

Natural radioactivity - detection and measurement of radioactivity – Geiger Nuttal rule - rate of disintegration and half life period - average life period - nuclear stability, n/p ratio, magic number, mass defect and binding energy - liquid drop model - shell model - isotopes, isobars, isotones and isomers. Artificial radioactivity - nuclear fission and nuclear fusion – mechanisms – applications - differences – Stellar energy - nuclear reactors - hazards of radiations - fertile and fissile isotopes. Applications of radioisotopes – C^{14} dating, rock dating, neutron activation analysis and isotope as tracers - study of reaction mechanism

Unit V Chemical kinetics (12 hrs.)

Rate of reaction-Measuring rates of reaction-expressing reaction rates- factors influencing rate-rate constant-Rate laws, Stoichiometry, order and molecularity of

reactions- Setting up and solving simple differential equation for first order, second order, third order and zero order reactions. Experimental techniques involved in following kinetics of reaction-Volumetry, manometry and colorimetry. Effect of temperature on rate constant. The activation energy - determination of Arrhenius frequency factor and energy of activation-The collision theory of reaction rates and its limitation. Lindemann theory of unimolecular reactions-The theory of Absolute reaction rates.Comparison of the collision theory with the Absolute reaction rate theory.

References

1. Principles of physical chemistry - Puri, Sharma and Pathania, Millennium Edition, Vishal Publishing Co, 2003.
2. Text Book of physical chemistry - P.L. Soni - Sultan Chand, 1983.
3. Atkins' Physical chemistry, 9th Edition, Oxford University Press, 2010.
4. Advanced Physical Chemistry - Gurdeep Raj, Goel Publishing House,2008.
5. Physical Chemistry, G.M.Barrow, Tata McGraw Hill, 2006
6. Chemical Kinetics KJ. Laidler, Tata McGraw Hill Publishing Company, New Delhi,1983.

COURSE OUTCOME MAPPING

	UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5
CO1	**L3**	**L1**	**L1**	**L1**	**L2**
CO2	**L2**	**L3**			**L2**
CO3		**L3**	**L2**	**L2**	**L3**
CO4			**L2**	**L2**	**L3**
CO5		**L3**	**L2**	**L3**	**L2**

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

INORGANIC PRACTICAL - II

Course code - HCHL21		
Credits	**Hours**	**Course**
2	**60**	**Practical**

Course Objectives

1. To enable the students to acquire the idea about gravimetric estimation.
2. In depth knowledge about inorganic preparation of salts.

COURSE PREREQUISITES

Students must study chemistry as one of the subjects in higher secondary level.

COURSE OUTCOMES

On the successful completion of this course, student will able to

1. Understand the concept of gravimetric titrations
2. Learn the preparation of inorganic compounds.
3. Determine the percentage yield of the compounds

Gravimetric Estimation

1. Estimation of lead as lead chromate
2. Estimation of barium as barium chromate
3. Estimation of nickel as nickel dimethylglyoximate
4. Estimation of zinc as zinc oxinate
5. Estimation of copper as copper thiocyanate

Inorganic preparations

1. Preparation of Potash alum
2. Preparation of Chrome alum
3. Preparation of Prussian blue
4. Preparation of Sodium ferrioxalate
5. Preparation of Tetramminecopper(II) sulphate
6. Preparation of Tristhiourea copper(I)chloridedihydrate
7. Preparation of Potassium trisoxalatoferrate(III)
8. Preparation of Hexathiourealead(II) nitrate

References

1. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part III), S. Viswanathan Co. Pvt., 1996.

2. Vogel's Text Book of Quantitative Chemical Analysis. 5th Edi., ELBS/Longman England, 1989.
3. O.P. Pandey, D.N Bajpai, S. Gini, Practical Chemistry, for I, II & III BSc. Students. S.Chand & Company Ltd reprint 2009.
4. V.K.Ahluwalia, Sunitha Dhingra, Adarsh GulateCollege Practical Chemistry, Universities Press (India) Pvt Ltd 2008 (reprint)
5. V.V. Ramanujam, Inorganic Semi Micro Qualitative Analysis, 3rd edition, The National Publishing Company, Chennai, 1974.
6. Vogel's Text Book of Inorganic Qualitative Analysis, 4th edition, ELBS, London, 1974.

COURSE OUTCOME MAPPING

	Expt 1	**Expt 2**
CO1	**L3**	
CO2		**L3**
CO3	**L2**	**L2**

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

SEMESTER III

PHYSICAL CHEMISTRY II

Course Objectives

Course code - HCHC31		
Credits	**Hours**	**Course**
4	**60**	**Core**

1. To study the concepts of chemical equilibrium, K_p, K_c and K_x relationship and Le-Chatelier principle for homo and heterogeneous equilibrium.
2. To examine the phase equilibrium for one and two component system
3. To analyse the behavior of the ideal and non-ideal solution and various separation techniques.
4. To recognize the Colligative properties of dilute solutions
5. To learn the ionic equilibrium and Hydrolysis of salts.

Course Prerequisites

1. Students must study chemistry as one of the subjects in higher secondary level.

Course Outcomes

At the end of the course the student will be able to

1. Remember the concept of equilibrium
2. Understand the concept of acid/ base theory and colligative properties
3. Acquire knowledge about various laws and phase diagrams
4. Formulate the phases for one and two component system
5. Determine the physical parameters related to equilibrium

Unit I Chemical equilibrium (12hrs.)

Reversible and irreversible reactions-nature of chemical equilibrium-Law of mass action-equilibrium constants- K_p, K_c and K_x Thermodynamic derivations -Relations between K_p, K_c and K_x- Temperature dependence of equilibrium constant- Van't Hoff isochore-Pressure dependence of equilibrium constant- Heterogenous equilibrium-Le-Chatelier principle-application of Le-Chatelier principle to homogenous equilibrium and physical equilibrium.

Unit II Phase equilibria (12 hrs.)

Phase rule - phase, component, degree of freedom - thermodynamic derivation of phase rule, One-component system: Phase diagrams of Water and sulphur systems.

Two component system: (i) Simple eutectic: Lead-silver system and potassium iodide-water system. (ii) Formation of compound with congruent melting point: Magnesium-zinc system and ferric chloride - water system. Distribution Law-Statement and thermodynamic derivation-association of the solute in one of the solvents- dissociation of the solute in one of the solvents-applications of the distribution law-solvent extraction.

Unit III Solutions (12hrs.)

Kinds of solutions - methods for expressing concentration - Molarity, molality, mole fraction, normality, mass fraction, parts per million -solutions of gases in liquid - Solubility of gases in liquids - Henry's law – statement and limitations.

Solutions of liquid in liquid– Binary liquid mixture - Ideal and non ideal solutions - Raoult's law. - deviation from ideal behavior - pressure - composition and temperature - Composition diagrams for completely miscible binary solutions - Fractional distillation -Azeotropic distillation - nature of azeotropic mixtures - partially miscible liquids - consolute temperature- critical solution temperature-system with upper CST, lower CST and upper and lower CST - Crismer test - Completely immiscible systems-steam distillation.

Unit IV Dilute solutions (12hrs.)

Colligative properties of dilute solutions: relative lowering of vapour pressure, elevation of boiling point, depression of freezing point and osmotic pressure, Ebullioscopic constant-Cryoscopic constant- Relation between colligative properties and Molecular mass –Osmosis-osmotic pressure-.laws of osmotic pressure -osmotic pressure and concentration of solute- Experimental methods for determining various colligative properties, degree of dissociation and association of solutes Abnormal molecular mass – Van't Hoff factor.

Unit V Ionic equilibria (12 hrs.)

The Ostwald's dilution law-experimental verification – limitations-acids and bases-Lewis concept-dissociation of weak acids and weak bases-dissociation of water-pH scale-common ion effect- its applications-buffer solution-different types-calculation of pH value of buffer solution. Hydrolysis of salts - salts of weak acids & strong base,

salts of weak base and strong acids, salts of weak acid and weak base - determination of degree of hydrolysis. Acid-base indicators- acid-base titration and use of indicators.Solubility product- Application of solubility product principle.

References

1) Principles of Physical chemistry-Puri,Sharma and Pathania 2004,Vishal Publishing Co., NewDelhi.
2) Text book of Physical Chemistry, P.L.Soni, O.P. Dharmarha& U.N. Dash, , 22ndEdn.,Sultan Chand & Sons, New Delhi,1993.
3) Essentials of Physical Chemistry - B.S.Bahl, Arun Bahl, G.D.Tuli,Reprint 2006,S.Chand & Company Ltd., New Delhi-110055.
4) Atkin's Physical Chemistry, 9th Ed, Peter Atkins & Julio de Paula, 2010.
5) A Text book of Physical Chemistry-A.S.Negi S.C Anand 2nd Edition-2007.

COURSE OUTCOME MAPPING

	UNIT 1	**UNIT 2**	**UNIT 3**	**UNIT 4**	**UNIT 5**
CO1	**L3**	**L3**	**L1**		**L3**
CO2	**L1**	**L3**	**L1**		**L3**
CO3		**L3**	**L1**		
CO4	**L3**	**L2**	**L2**	**L1**	**L3**
CO5	**L1**			**L3**	**L3**

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

NON-MAJOR ELECTIVE- FOOD CHEMISTRY

Course code - HCHNE1		
Credits	**Hours**	**Course**
2	**45**	**NME**

Course Objectives

1. To provide comprehensive introduction to chemistry of food
2. To understand functional properties of carbohydrates, proteins, aminoacids and lipids
3. To understand the chemical changes in food components during processing and storage,
4. To understand the importance and sources of fats and oils in foods
5. To provide comprehensive introduction of food additives, pigments, flavoring agents and preservatives.

Course prerequisites

1. Students must study chemistry as one of the subject in higher secondary level.

Course outcomes

After successful completion of the course, students will be able to

1. Learn about the basic constitution of food
2. analyze and tabulate the chemical and functional properties food
3. explain the effect of storage processing and adulteration process of food components
4. analyze the limit of food additives, pigments, flavoring agents and preservatives in given food according to quality standards

Unit I Introduction (9 hrs.)

Food : sources and classification – food as a source of energy - functions and biological importance of carbohydrates, protein, fat, vitamins and minerals - calorific value of food – energy requirements of individuals - balanced diet.

Unit II Food additives (9 hrs.)

Definition, food colourants : natural and artificial - antioxidants, stabilizers, flavours, bleaching and maturing agents – leavening agents.

Unit III Food preservatives (9 hrs.)

Definition - classification - methods of food preservation and processing by heat, cold, radiation, drying and deep freezing.

Unit IV Food adulteration (9 hrs.)

Definition – types – detection and analysis of adulterants in foods: milk, chilli powder, coffee powder, turmeric powder, ghee, oil and pulses.

Unit V Quality standards (9 hrs.)

Quality control - specification and standards - FA, WHO standards – packing and labeling of foods, Essential Commodities Act - Consumer Protection Act - AGMARK.

References

1. Sivasankar B, Food Processing and Preservation, Prentice Hall of India Pvt. Ltd, New Delhi, 2002.
2. Swaminathan M. Textbook on Food Chemistry, Printing and Publishing Co, Ltd, Bangalore 1993.
3. Food Science – III Edition – Sri Lakshmi B, New Age International Publisher, 2005.
4. Fundamentals of Foods and Nutrition – Mudambi. R. Sumathi, and Rajagopal, M.V. - Willey Eastern Ltd, Madras, 1982.

COURSE OUTCOME MAPPING

	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	**L3**	**L2**	**L2**		
CO2	**L3**	**L1**	**L1**		**L3**
CO3		**L3**	**L3**	**L1**	**L1**
CO4	**L1**	**L2**	**L2**	**L3**	**L2**

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

NON-MAJOR ELECTIVE- WATER MANAGEMENT

Course code – HCHNE2		
Credits	**Hours**	**Course**
2	**30**	**N M E**

Course Objectives

1. To realize the importance of quality water in day-to-day life

Course Prerequisites

1. Students must study chemistry as one of the subject in higher secondary level.

Course outcomes

Upon successful completion of the course, the students will be

1. get acquainted to the source of water pollution
2. understand that detect facilities water quality parameters.
3. analyze various water purification methods .
4. undertake an independent waste water treatment process.
5. plan the restoration and management of water.

Unit I Water pollution (9 hrs.)

Definition-sources of water pollution-types of water pollutants: sewage and domestic wastes, industrial effluents, agricultural discharges, detergents, disease causing agents and radioactive materials. Eutrophication and its effects.

Unit II Water quality parameters (9 hrs.)

Physical, chemical and biological water quality parameters-water quality standards for drinking water - BIS and WHO. Determination of pH, Total hardness, DO, BOD and COD.

Unit III Water purification (9 hrs.)

Purification of water for drinking purposes: Sedimentation, filtration and disinfection- Desalination: reverse osmosis-Purification of water for industrial purposes: water softening-permutit process and ion-exchange process.

Unit IV Waste water treatment (9 hrs.)

Elementary ideas of waste water treatment: pre-treatment-primary treatment-secondary treatment: aerobic and anaerobic processes - tertiary treatment: evaporation adsorption - chemical precipitation.

Unit V Restoration and management (9 hrs.)

Importance of lakes and rivers-stresses on the Indian rivers and their effects - A restoration case study: Ganga Action Plan: objectives implementation and drawbacks. Rain water harvesting - Nwater recycling- The water Prevention and control of Pollution Act 1974.

References

1. A. K. De, Environmental Chemistry, Wiley Eastern Ltd., New Delhi, 1994.
2. B. K. Sharma, Environmental Chemistry, Goel Publishing House, Meerut, 1997.
3. R. K. Trivedy and P. K. Goel, Chemical and biological methods for water pollution studies, Environmental Publications, Karad, India,1986.
4. BIS 1991, Specification for drinking water, Bureau of Indian Standards, New Delhi
5. WHO 1992, International standards for drinking water, World Health Organisation, Geneva.

COURSE OUTCOME MAPPING

	UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5
CO1	**L3**	**L1**		**L1**	**L1**
CO2		**L3**		**L1**	
CO3		**L1**	**L3**	**L2**	
CO4		**L2**		**L3**	**L1**
CO5	**L1**			**L1**	**L3**

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

ORGANIC PRACTICAL-I

ORGANIC ANALYSIS

Course code - HCHL31		
Credits	**Hours**	**Course**
2	**60**	**Practical**

Course Objectives

1. To analyze and identify the organic compounds

Course Prerequisites

1. Students must study chemistry as one of the subjects in higher secondary level.

Course Outcomes:

At the end of the course, the student will be able to:

1. Analyse the organic compounds
2. Identity the functional groups present in an organic compound.
3. Determine the yield of organic derivatives.
4. Create a method for the qualitative and quantitative analysis of organic compounds

Practicals

Qualitative analysis of the given organic compound

a. Test for aliphatic and aromatic nature of substances
b. Test for saturation and unsaturation
c. Identification of functional groups (carboxylic acids, phenols, aldehydes, ketones, esters, amines, amides, anilides, nitrocompounds and carbohydrates)
d. Preparation of solid derivative to confirm the presence of functional group

References

1. N.S. Gnanapragasam and G. Ramamurthy, Organic Chemistry – Lab manual, S. Viswanathan Co. Pvt., 1998.
2. J.N. Gurthu and R. Kapoor, Advanced Experimental Chemistry (Organic), S. Chand and Co., 1987.
3. B.S. Furniss, A.J. Hannaford, P.W. G. Smith and A.R. Tatchell, Vogel's Text Book of Practical Organic Chemistry. 5th Edn., Pearson Education, 2005.
4. O.P. Pandey, D.N Bajpai, S. Gini, Practical Chemistry, for I, II & III BSc. Students. S.Chand & Company Ltd reprint 2009.
5. P.R.Singh, D.C.Gupta, K.S.BajpalExperimental Organic Chemistry Vol.I and II, 1980.

COURSE OUTCOME MAPPING

	EXPERIMENT 1
CO1	**L3**
CO2	**L3**
CO3	**L3**
CO4	**L3**

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

SEMESTER IV

ORGANIC CHEMISTRY - II

Course code – UCH41		
Credits	**Hours**	**Course**
4	**60**	**Core**

Course Objectives

1. To study about aldehydes and ketones
2. To understand the reactivity of carboxylic acids & acid derivatives
3. To learn about the aliphatic nitrogen compounds
4. To study about the reactivity of methylene compounds & tautomerism
5. To know about alicyclic compounds and its properties

Course Prerequisites

1. Students must study chemistry as one of the subject in higher secondary level.

Course Outcomes

At the end of the course the student will be able to

1. Learn about various preparative methods of substituted hydrocarbons with its mechanism
2. Demonstrate the chemical properties of nitro, carbonyl and acid derivative compounds
3. Compare the physical properties of substituted hydrocarbons

Unit I Aldehydes and ketones (12 hrs.)

Structure and reactivity of carbonyl group – relative reactivities of aldehydes and ketones – mechanism of nucleophilic addition reaction (HCN, $NaHSO_3$, Grignard reagent) – mechanism of aldol condensation, crossed aldol condensation, Knoevenagal reaction, Reformatsky reaction.

Study of the following reactions – Wolff-Kishner reduction, Wittig reaction, MeerweinPonndorfVerley reduction.

Preparation, properties and uses of chloral, acrolein, crotonaldehyde and succinaldehyde.

Unit II Carboxylic acids & acid derivatives (12 hrs.)

Structure of carboxylic acid and carboxylate anion - relative strengths of monocarboxylic acids - effect of substituents on acidity - Hell - Volhard - Zelinsky reaction - action of heat on hydroxy acids - preparation, properties and uses of lactic

acid and citric acid–dicarboxylic acids: action of heat on dicarboxylic acids - preparation, properties and uses of oxalic acid and succinic acid. Acid anhydrides - Amides - Preparation, properties and structure of urea - Esters- mechanism of esterification and ester hydrolysis.

Unit III Aliphatic nitrogen compounds (12 hrs.)

General methods of preparation of primary, secondary and tertiary amines - General Properties - Isomerism - Stereochemistry - basic character of amines - Distinction between primary, Secondary and tertiary amines. Preparation and properties of quartenary ammonium compounds.Preparation and reactions of diazo methane and diazoacetic ester

Unit IV Reactive methylene compounds & tautomerism (12 hrs.)

Reactivity of methylene groups - preparation and synthetic uses of diethyl malonate, ethyl acetoacetate and ethyl cyanoacetate.

Tautomerism - definition - various types, keto - enol, amido - imido, nitro - acinitro and oxime - nitroso tautomerism.

Unit V Alicyclic compounds (12 hrs.)

Nomenclature - general methods of preparation - spectroscopic properties – chemical properties - relative stabilities of cyclo alkanes - Baeyer's strain theory – Sachse-Mohr theory - Coulson and Moffit's concept - conformations of cyclohexane and monosubstituted cyclohexanes - largering compounds - synthesis and structure of civetone and muscone (structure elucidation not necessary).

References:

1. K.S. Tewari, N.K. Vishil, S.N. Mehotra – A text book of org. chem – 1st edition,
2. Vikas Publishing House Pvt. Ltd., 2001, New Delhi.
3. P.L. Soni, Text Book of Organic chemistry, Sultans chand, 1991, New Delhi,
4. Bahl and Arun Bahl, Organic Chemistry, S. Chand and Sons, New Delhi, 2005.
5. M.K. Jain and S. C. Sharma, Modern Organic Chemistry, 2017.
6. Organic Chemistry - R.T.Morrison and Boyd - Prentice Hall, 2002.
7. Advanced General Organic Chemistry - SachinK.Ghosh - Books and Allied (P) Ltd

8. Organic Chemistry – Bhupinder Mehta and Manju Mehta - PHI Learning Pvt. Ltd, 2008.

COURSE OUTCOME MAPPING

	Unit I	**Unit II**	**Unit III**	**Unit IV**	**Unit V**
CO1	**L3**	**L3**	**L3**	**L3**	**L2**
CO2	**L3**	**L2**	**L2**	**L2**	**L1**
CO3	**L1**	**L2**	**L2**	**L3**	**L3**

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

NON MAJOR ELECTIVE-APPLIED CHEMISTRY

Course code – HCHNE3		
Credits	**Hours**	**Course**
2	**30**	**N M E**

Course Objectives

1. To acquire knowledge about the chemicals used in day-to-day life

Course Prerequisites

1. Students must study chemistry as one of the subjects in higher secondary level.

Course Outcomes:

At the end of the course, the student will be able to:

1. Explain basics of Applied chemistry.
2. Understand the properties of detergents and polymers
3. Know the therapeutic uses of familiar things

Unit I Soaps and detergents (9 hrs.)

a. Soaps: Definition-classification-raw materials used in the manufacture of soap – manufacture of toilet soap.
b. Detergents: Definition –various types with examples- advantages of detergents over soaps –cleansing action of soap.

Unit II Fertilizers (9 hrs.)

Definition-characteristics of a good fertilizer- role of nitrogen, potassium and phosphorous in plant growth – natural fertilizers- chemical fertilizers: urea, muriate of potash and triple superphosphate - mixed fertilizers - biofertilizers – advantages of biofertilizers.

Unit III Polymers (9 hrs.)

a. Fibers: Classification - uses of terylene, nylon and orlon.
b. Resins: Natural resins - synthetic resins-type-uses of fevicol, quick fix, araldite, glyptaland Bakelite.
c. Plastics: classification- differences between thermoplasts and thermosets. Advantages of plastics-uses of polythene, PVC, polystyrene, Teflon and thermocole.
d. Rubber: Types-defects in natural rubber-vulcanization - synthetic rubbers- uses of neoprene, thiocol, butyl rubber, silicone rubber and foam rubber.

Unit IV Chemicals in pharmacy (9 hrs.)

Definition and therapeutic uses of the following (an elementary study only)

a. Antiseptics: alum, boric acid
b. Mouth washes: Hydrogen peroxide
c. Antacids: Aluminium hydroxide
d. Analgesics: Aspirin, paracetamol
e. Antibiotics: Penicillins, tetracyclines
f. Haematinics: Ferrous fumerate, ferrous gluconate
g. Laxatives: Epsom salt, milk of magnesia
h. Sedatives: Diazepam

Unit V Chemicals in day-to-day life (9 hrs.)

An outline of the preparation and uses of the following articles.Tooth powder, tooth paste, writing inks, gum paste, boot polish, talcum powder, chalk crayons, agar battis, phenyl and moth balls.

References

1. B. K. Sharma, Industrial Chemistry, Goel Publishing House, Meerut, 2000.
2. Jeyashree Gosh, A text book of Pharmaceutical Chemistry, S. Chand and Company, NewDelhi, 2014.
3. B. N. Chakrabarty, Industrial Chemistry, Oxford and IBH Publishing Co. Pvt. Ltd., Calcutta, 2005.

COURSE OUTCOME MAPPING

	UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5
CO1	**L3**	**L3**	**L3**	**L1**	**L1**
CO2	**L3**	**L3**	**L3**	**L2**	**L1**
CO3				**L3**	**L3**

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

NON MAJOR ELECTIVE-CLINICAL CHEMISTRY

Course Objectives

1. To know about the safety in laboratory
2. To know basic first aids
3. To acquire skill in biochemical analysis

Course code – HCHNE4		
Credits	**Hours**	**Course**
2	**30**	**N M E**

Course Prerequisites

1. Students must study chemistry as one of the subjects in higher secondary level.

Course Outcomes:

At the end of the course, the student will be able to:

1. learn the he safety measures in laboratory.
2. understand the features of first aid and blood.
3. identify and analyze the chemical components of blood

Unit I Lab Safety Precautions (9 hrs.)

Safety in laboratory-importance-safety equipments-personal protection-dangers to avoid chemical hazards-corrosive, irritants, toxic, flammability and explosive hazards Physical hazards - fire, pressure and radiation Biological hazards-micro organisms and animal body fluids Spillage and waste disposal.

Unit II Lab First Aid (9 hrs.)

First aids for accidents-important rules of first aid, First aid for cuts and abrasions, First aid for bleeding and fractures,First aid for burns, fainting and poisonous bites, First aid box.

Unit III Analysis of Blood sample I (9 hrs.)

Blood: Definition-functions and composition-collection of blood through vein puncture and finger prick-Haemolysis agents-precautions.Anti coagulants - definition, types and quantity used for tests. Haemotopoiesis -erythropoiesis, leucopoiesis and thrombopoiesis.

Unit IV Analysis of Blood sample II (9 hrs.)

Blood hemoglobin-methods and procedure for hemoglobin test. Total RBC count-RBC indices-retculocyte count-normal values-increased and decreased conditions.

Classification of leucocytes-functions-total WBC count-morphology types of WBC-total eosnophil count-normal values- increased and decreased conditions.

Unit V Blood donor screening (9 hrs.)

Blood group system-blood groups-importance, types, antigen and agglutination antigen-antibodies in different groups. Blood transfusion: detailed blood donor screening procedure-blood collection-anticoagulants in blood bank-storage of donor blood.

References

1. Text Book of Medical Lab Technology – Praful B. GodkarandDarshar P. Godkar, Bhaiani Publishing House, 2006
2. Clinical Laboratory Methods – Jolm D. Bener, Mosby, 2012.
3. Clinical Chemistry in Diagnosis and Treatment – Ziwa I. F. P. Peter, Mayne P. D., Year Book Medical Publishers, 1994.
4. Medical Lab Technology – RamnikSood, JPB, 1999.
5. Practical Clinical Biochemistry – W. H. Heinemann, Verley Publications, 1969.

COURSE OUTCOME MAPPING

	UNIT 1	**UNIT 2**	**UNIT 3**	**UNIT 4**	**UNIT 5**
CO1	**L3**	**L1**	**L2**		
CO2		**L3**	**L2**		**L3**
CO3		**L1**	**L3**	**L3**	**L3**

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

Organic Chemistry Practical-II

Organic Preparation & Determination of Physical Constant

Course code – HCHL41		
Credits	**Hours**	**Course**
2	**60**	**Practical**

Course Objectives

1. To provide training on organic preparation
2. To provide experimental skill and training to determination of boiling point/ melting point

Course Prerequisites

Students must study chemistry as one of the subjects in higher secondary level.

Course Outcomes:

At the end of the course, the student will be able to:

1. List the properties of reagents/ solvents in laboratory.
2. Understand and apply the synthetic methods for preparations of organic compounds.
3. Determine the yield percentage and melting point of the reaction

Practicals

1. Organic preparation

a. Preparation of salicylic acid from methyl salicylate/ benzoic acid from ethylbenzoate
b. Preparation of benzoic acid from benzamide
c. Preparation of acetyl salicylic acid from salicylic acid/ acetanilide from aniline
d. Preparation of benzoic acid from benzaldehyde
e. Preparation of p-bromoacetanilide from acetanilide
f. Preparation of 2-naphthyl benzoate from 2-naphthol
g. Preparation of picric acid from phenol
h. Preparation of methyl orange from sulphanilic acid

2. Determination of boiling point/ melting point of the given organic compound

References

1. N.S. Gnanapragasam and G. Ramamurthy, Organic Chemistry – Lab manual, S. Viswanathan Co. Pvt., 1998.
2. J.N. Gurthu and R. Kapoor, Advanced Experimental Chemistry (Organic), S. Chand and Co., 1987.

3. B.S. Furniss, A.J. Hannaford, P.W. G. Smith and A.R. Tatchell, Vogel's Text Book of Practical Organic Chemistry. 5th Edn., Pearson Education, 2005.
4. O.P. Pandey, D.N Bajpai, S. Gini, Practical Chemistry, for I, II & III BSc. Students. S.Chand & Company Ltd reprint 2009.
5. P.R.Singh, D.C.Gupta, K.S.BajpalExperimental Organic Chemistry Vol.I and II, 1980.

COURSE OUTCOME MAPPING

	EXPERIMENT 1	**EXPERIMENT 2**
CO1	**L3**	**L2**
CO2	**L3**	**L1**
CO3	**L3**	**L3**

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

SEMESTER –V

ORGANIC CHEMISTRY – III

Course code – HCHC51		
Credits	**Hours**	**Course**
4	**60**	**Core**

Course Objectives

1. To study the Stereochemistry and concept of isomerism.
2. To know the importance of aromatic substitution reaction.
3. To study the preparation, properties & uses of polynuclear hydrocarbons.
4. To know the importance of heterocyclic compounds.
5. To know the classification of Dyes

Course Prerequisites

1. Students must study chemistry as one of the subject in higher secondary level.

Course Outcomes

At the end of the course the student will be able to

1. Acquire knowledge Stereochemistry of addition and substitution reaction
2. Know the methods of preparation of polynuclear hydrocarbons, heterocyclic compounds and Dyes
3. Understand the chemical and physical properties of polynuclear hydrocarbons, heterocyclic compounds and Dyes

Unit I Stereochemistry (12 hrs.)

Stereoisomerism - definition - classification into optical and geometrical isomerism. Projection Formulae - Sawhorse and Newman projection formulae - Notation of Optical isomers - D-L notation- Cahn-Ingold-Prelog rules - R-S notations for optical isomers.

Optical isomerism - optical activity - optical and specific rotations - conditions for optical activity - asymmetric centre - chirality - achiral molecules. Elements of symmetry - Racemisation - methods of racemisation. Resolution - methods of resolution (mechanical, seeding, biochemical)

Geometrical isomerism - cis-trans and E-Z notations - Geometrical isomerism in maleic and fumaric acids and unsymmetrical ketoximes - Methods of distinguishing. Geometrical isomers using melting point, dipole moment, dehydration and cyclisation.

Unit II Aromatic substitution (12 hrs.)

General mechanism of electrophilic substitution, mechanism of halogenation, nitration, sulphonation. Orientation of aromatic substitution - Definition of ortho, para and meta directing groups. Direct influence of substituents - rules of orientation- Aromatic Nucleophilic substitutions- unimolecular, bimolecular and benzyne mechanisms- homolytic aromatic substitution (side chain halogenation of alkyl benzenes.).

Unit III Polynuclear hydrocarbons (12 hrs.)

- ✓ Isolatedsystems :-Preparation of diphenyl, diphenyl methane, triphenyl methane and stilbene.
- ✓ Condensed systems:- Synthesis, reactions, structure and uses of naphthalene.Preparation and reactions of naphthols, naphthylamine and naphthaquinone.

Synthesis, Reactions, structure and uses of anthracene – Preparation and reactions of anthraquinone. Synthesis and structure of alizarin phenanthrene..

UNIT IV Heterocyclic Compounds (12 hrs.)

Preparation, properties and uses of furan, pyrrole & thiophene - aromatic character.Synthesis and reactions of pyridine and piperidine - comparative study of basicity of pyrrole, pyridine and piperidine with amines.

Condensed five and six membered heterocyclics - preparation and reactions of indole, quinoline and isoquinoline - Fischer indole synthesis, Skraup synthesis and Bischer-Napieralski synthesis.

UNIT V Dyes (12 hrs.)

Theory of colour and constitution – Witt's chromophore theory - resonance theory, valence bond theory and modern theory.

Dyes - requirements of a dye - Classification - according to structure and method of application.

Preparation, structure and uses of

a. Nitro dyes – Picric acid and Naphthol green
b. Azo dyes - Methyl orange and Bismark brown
c. Triphenyl methane dyes - Malachite green and Crystal violet

d. Phthalein dyes - Phenolphthalein
e. Vat dyes - Indigo
f. nthraquinone dyes - Alizarin.

References

1. Textbook of Organic Chemistry - A.K.Bansal - New Age, 2017.
2. Organic Chemistry - I.L.Finar - Volume I & II – AddisionWesley, 2011.
3. Organic Chemistry - R.T.Morrison and Boyd - Prentice Hall, 2001.
4. Stereochemistry of Organic Compounds - D.Nasipuri - New Age, 1994.
5. Stereochemistry, Conformation and Mechanisms - Kalsi New Age, 2005.
6. Advanced General Organic Chemistry – Sachin K.Ghosh - Books and Allied (P) Ltd, 2008.
7. Textbook of Organic Chemistry - P.S. Kalsi – Macmillan, 2008.
8. Organic Chemistry – Bhupinder Mehta and Manju Mehta - PHI Learning P Ltd.

COURSE OUTCOME MAPPING

	Unit I	**Unit II**	**Unit III**	**Unit IV**	**Unit V**
CO1	**L3**	**L3**	**L3**	**L1**	
CO2	**L2**	**L2**	**L2**	**L2**	**L3**
CO3	**L3**	**L2**	**L2**	**L2**	**L2**

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

INORGANIC CHEMISTRY - III

Course code – HCHC52		
Credits	**Hours**	**Course**
4	**60**	**Core**

Course Objectives

1. To study the chemistry of noble gases
2. To study the theories in coordination chemistry
3. To study the chemistry of metal carbonyls
4. To understand the role of metal ions in biological systems
5. To study the basic principles of photoinorganic chemistry

Course Prerequisites

1. Students must study chemistry as one of the subject in higher secondary level.

Course Outcomes:

At the end of the course, the student will be able to:

1. Recall the constitution and properties of periodic table
2. Learn the concepts in coordination chemistry
3. Identify the elements based on physical and chemical properties
4. Criticize the bioinorganic compounds.

Unit I Chemistry of f- Block elements (12 hrs.)

General characteristics of f-block elements – comparative account of lanthanides and actinides – occurrence, oxidation states, magnetic properties, colour and spectra – separation by ion exchange and solvent extraction methods – lanthanide contraction – chemistry of thorium and uranium – occurrence, ores, extraction and uses – preparation, properties and uses of ceric ammonium sulphate, thorium dioxide, thorium nitrate, uranium hexafluoride, uranylacetate

Unit II Noble gases (12 hrs.)

Occurrence - isolation of noble gases from the atmoshphere - separation of the gases from one another - general physical properties - special properties of helium - isotopes of helium - uses of noble gases - importance of inert gases in theoritical chemistry - chemical properties - xenon chemistry preparation and properties of fluorides, oxides and oxofluorides of xenon - xenates and perxenates - xenon fluoride complexes - structure and bonding in xenon compounds. Fluorides of kripton and radon - hydrates and clathrates of noble gases - uses of clathrate compunds

Unit III Co-ordination chemistry II (12 hrs.)

Crystal field theory - splitting of d-orbitals in octahedral and tetrahedral complexes - factors affecting the magnitude of crystal field splitting - effects of crystal field splitting - spectrochemical series - applications of CFT - magnetic properties and spectra of transition metal complexes - crystal field stabilization energy and their uses - limitations of CFT - effective atomic number rule - stability of complexes - step-wise and overall stability constants - factors affecting the stability of complexes - determination of stability constants.

Unit IV Co-ordination chemistry III (12 hrs.)

Labile and inert complexes - ligand substitution reactions in octahadral complexes aquation, base hydrolysis and anation reactions - substitution reactions in square planner complexes - trans effect - theories of trans effect - mechanism of substitution reactions - redox reactions : inner-sphere and outer-sphere electron transfer reactions - metal carbonyls : 18 electron rule as applied to metal carbonyls - preparation, properties and structure of mono, di and polynucluer carbonyls of Cr, Mn, Fe, Co and Ni - nature of M-L bond in metal carbonyls - metal nitrosyls.

Unit V Bioinorganic chemistry (12 hrs.)

Role of alkali and alkaline earth metals in biological systems and their transport across the membranes - the effect of excess and deficiency of essential trace metals (Cu, Fe, Co and Zn) - metalloporphyrins - myoglobin and hemoglobin - dioxygen binding - co-operativity in hemoglobin - the Bohr effect - chlorophyl - vitamin B_{12}. Metal complexes of copper, gold and platinum as therapeutic agents - chelation therapy in metal poisoning.

References :

1. J.D. Lee, Concise Inorganic Chemistry 5th Ed., Blackwell Science Ltd.,
2. James E. Huheey, Elien A. Keiter and Richard L. Keiter, Inorganic Chemistry : Principles Structure and Reactivity, 4th Ed., Harper College Publisher.
3. F. Albert Cotton, Geoffrey Wilkinson, Carlos A. Marilo and Manfred Bochman, Advanced Inorganic Chemistry, 6th Ed., Wiley Interscience Publication.

4. Fred Basolo and Ralph G. Pearson, Mechanisms of Inorganic Reactions : A study of metal complexes in solution, 2nd Ed., John wiley and sons, Inc.,
5. David E. Fenton, Biocoordination Chemistry, Ist Ed., Oxford Science Publications.
6. IvanoBertini, Harry B Gray, Stephen J Lippard, Joan Selverstone Valentine, Bioinorganic Chemistry, 1st Ed., Viva Books Pvt. Ltd.,
7. J.K. Rohatgi - Mukherjee, Fundamentals of Photochemistry - Wiley Eastern Revised Ed.,
8. Journal of Chemical Education, Vol.60, No.10, October 1983.
9. A.W. Adamson and P.D. Fleischauer, (Editors) Concepts of Inorganic photochemistry, John wiley and sons, New York, 1975.

COURSE OUTCOME MAPPING

	UNIT 1	**UNIT 2**	**UNIT 3**	**UNIT 4**	**UNIT 5**
CO1	**L3**	**L3**	**L1**		
CO2	**L1**	**L1**	**L3**	**L3**	**L2**
CO3	**L2**	**L2**	**L1**	**L1**	**L1**
CO4			**L2**	**L2**	**L3**

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

PHYSICAL CHEMISTRY – III

Course code –HCHC53		
Credits	**Hours**	**Course**
4	**60**	**Core**

Course Objectives

1. To study the concepts in thermodynamics, different thermodynamic quantities such as heat and work and how they are measured, related or transformed from one to the other states of matter and how they depend on temperature and pressure as well as how they co-exist in phase equilibria, chemical equilibrium and its relationship with thermodynamic quantities.
2. To revise the principles of electrochemistry with the transport of ions.
3. To analyze the applications of Kohlrausch'slaw and conductance measurement.
4. To examine the types of electrochemical cells and on its applications.
5. To apply the emfto evaluate chemical equilibrium and its relationship with thermodynamic quantities.

Course Prerequisites

1. Students must study chemistry as one of the subjects in higher secondary level.

Course Outcomes

At the end of the course the student will be able to

1. Remember laws of thermodynamics and electrochemistry.
2. Understand the importance of ΔU, ΔH, ΔS and ΔG(physical quantities)
3. Analyze the reactions in electrolytic cells and electrochemical cells.
4. evaluate the thermodynamic parameters.
5. Apply the gained knowledge in research and /or industries

Unit I Thermodynamics-I (12hrs.)

Basic concepts - system, surroundings - types of systems - extensive and intensive properties - state functions and path functions - types of processes - . Exact and inexact differentials -Zeroth law of thermodynamics. Statements of first law - definition of internal energy and enthalpy - heat capacities at constant volume (C_v) and at constant pressure (C_p), relationship between C_p and C_v - calculation of work, heat, internal energy change and enthalpy change for the expansion of an ideal gas under reversible isothermal and adiabatic conditions. Joule-Thomson effect – Joule-Thomson coefficient and its significance - derivation of the expression for Joule-Thomson

coefficient - inversion temperature.Kirchoff's equation and its applications - numerical problems.

Unit II Thermodynamics-II (12hrs.)

Introduction to second law of thermodynamics - spontaneous processes - statement of second law of thermodynamics.

Entropy: Definition –entropy a state function - Trouton's rule -entropy change in reversible and irreversible processes- Clausius inequality- entropy as function of T and V - entropy as a function of T and P - entropy change in isothermal transformation - entropy change accompanying change of phase - entropy of mixing of ideal gases - physical significance of entropy.

Free energy: Work and free energy functions – definition-general conditions of equilibrium and spontaneity -physical significance of dA and dG. Temperature and pressure dependence of G - variation of G during isothermal change -Gibbs Helmholtz equation.

Unit III Thermodynamics-III (12hrs.)

Van't Hoff isotherm and isochore - Clapeyron equation-Clapeyron-Clausius equation-Applications of Clapeyron-Clausius equation.

Third law of thermodynamics: Nernst heat theorem- statement of III law and its applications. Exception to third law- experimental verification of the law-residual entropy-Evaluation of absolute entropy from heat capacity measurements.

Partial molar properties: Partial molar free energy. The concept of chemical potential - variation of chemical potential with T and P- Gibbs Duhem equation- concept of fugacity and activity- activity coefficient - standard states.

Unit IV Electrochemistry- I (12 hrs.)

Metallic and electrolytic conductance - Definitions of specific, equivalent and molar conductances - Relations between them - measurement of conductance and cell constant. Variation of conductance with dilution - Qualitative explanation - Strong and weak electrolytes. Migration of ions - transport number - determination by Hittorf and moving boundary methods - Kohlrausch's law - applications - calculation of equivalent conductance for weak electrolytes and determination of transport number.

Ionic mobilities and Ionic conductances. Diffusion and ionic mobility- molar ionic conductance and viscosity- Walden rule-Applications of conductance measurements - Degree of dissociation of weak electrolytes - Determination of Ionic product of water - Determination of solubility of sparingly soluble salts - conductometric titrations.

Unit V Electrochemistry –II **(12 hrs.)**

Galvanic cells - Reversible and Irreversible cells - EMF and its measurement - Weston Standard cell - types of reversible single electrodes - standard Hydrogen electrode - calomel electrode - Derivation of Nernst equation both for emf of cells and single electrode potentials–significance.Application of emf measurements – Application of Gibbs -Helmholtz equation to galvanic cells - calculation of thermodyamic quantities - pH using hydrogen, quinhydrone and glass electrodes - potentiometric titrations. Concentration cells - electrode concentration cells- electrolyte concentration cells- concentration cells with and without transference .

References :

1. B.R. Puri, L.R. Sharma & M.S. Pathania, Principles of Physical Chemistry, Vishal
2. Publishing Co., Jalandhar.
3. P.L. Soni, O.P. Dharmarha& U.N. Dash, Text book of Physical Chemistry, 22nd Edn., Sultan Chand & Sons, New Delhi.
4. Essentials of Physical Chemistry– B.S.Bahl, Arun Bahl, G.D.Tuli, Reprint 2006,S.Chand & Company Ltd., New Delhi-110055.
5. Physical Chemistry volumes I & II- S.Pahari, 2004, New Central Book Agency,Kolkotha.
6. Physical Chemistry-G.M.Barrow, 2005, Tata McGraw Hill Publishing Company,New Delhi.
7. Physical Chemistry-G.K.Vemulapalli, 2004, Prentice Hall of India.
8. Thermodynamics for Students of Chemistry- Rajaram & Kuriacose, 2013.
9. Thermodynamics for Chemists- Samuel Glasstone, 2017.

COURSE OUTCOME MAPPING

	UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5
CO1	L3	L3	L2		
CO2		L3	L2		L1
CO3				L3	L3
CO4			L1	L2	L3
CO5	L1	L1	L2	L2	L3

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

SKILL BASED CORE – I - FOOD CHEMISTRY

Course code – HCHSC1		
Credits	**Hours**	**Course**
4	**60**	**SBC**

Course Objectives

1. To acquire the basic knowledge of food chemistry

Course Prerequisites

1. Students must study chemistry as one of the subject in higher secondary level.

Course outcomes

Upon successful completion of the course, the students will be able to

1. Learn about the basic constitution of food
2. analyze and tabulate the chemical and functional properties food
3. explain the effect of storage processing and adulteration process of food components
4. analyze the limit of food additives, pigments, flavoring agents and preservatives in given food according to quality standards

Unit I Constitution of food (12 hrs.)

Food - definition - classification of food - energy requirements of individuals - source, classification and function of carbohydrates, proteins, lipids, vitamins and minerals - calorific values of food - rice, wheat, milk, fish, vegetables, fruits and cereals.

Unit II Food additives and preservatives (12 hrs.)

Food additives: Definition - permitted food additives, characteristics and their role: antioxidants, stabilizers, flavours, sweeteners, emulsifiers, thickeners, food colourants.

Preservatives: Definition – methods of food preservation - heat, cold, deep-freezing, radiation.

Unit III Food adulterations (12 hrs.)

Definition - adulterant, adulteration - types of adulterants - common adulterants and their determination in milk, oils, ghee, honey, chilly powder, coriander powder, turmeric powder, coffee powder, tea dust, asafoetida - food poisoning and its prevention – Prevention of Food Adulteration Act- food laboratories and their functions.

Unit IV Quality standards (12 hrs.)

Quality control - specification and standards - FA, FDA, WHO standards - ISI specifications, packing and labeling of foods - Essential Commodities Act, Consumer Protection Act - AGMARK.

Unit V Estimation and analysis methods (12 hrs.)

a. Determination of fat, protein and carbohydrate in food stuff.
b. Analysis of fats and oils - iodine value, acid value and RM value.
c. Estimation of glucose by Bertranel method
d. Analysis of starch in foods
e. Isolation of casein from milk

References

1. Sivasankar B, Food Processing and Preservation, Prentice Hall of India Pvt. Ltd, New Delhi, 2002.
2. Swaminathan M. Textbook on Food Chemistry, Printing and Publishing Co, Ltd, Bangalore, 1993.
3. N. S. Gnanaprakasam, G. Ramamurthy, Organic Chemistry, Lab Manual, S. Viswanathan Printers and Publishers Ltd.
4. Food Science –– B. Sri Lakshmi, New Age International Publisher, 2005.
5. Fundamentals of Foods and Nutrition – Mudambi. R. Sumathi, and Rajagopal, M.V. Willey Eastern Ltd, Madras.

COURSE OUTCOME MAPPING

	Unit I	Unit II	Unit III	Unit IV	Unit V
CO1	**L3**	**L2**	**L2**		
CO2	**L3**	**L1**	**L1**		**L3**
CO3		**L3**	**L3**	**L1**	**L1**
CO4	**L1**	**L2**	**L2**	**L3**	**L2**

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

SKILL BASED CORE – I - AGROCHEMISTRY

Course Objectives

1. To study detailed about fertilizers, pesticides, Insecticides, fungicide and herbicide
2. To learn about Soil characteristics and soil testing

Course code – HCHSC2		
Credits	**Hours**	**Course**
4	**60**	**SBC**

Course prerequisites

1. Students must study chemistry as one of the subjects in higher secondary level.

Course outcomes

Upon successful completion of the course, the students will be able to

1. Impart knowledge on essential nutrients and constitution of soil
2. Learn the classification of fertilizer and pesticides
3. Analyze the role of fertilizers/pesticides/acidity of soil
4. Adapt the learned concept in agriculture.

UNIT I Fertilizers (12 hrs.)

Fertilizers : Classification, macronutrients -role of nitrogen, potassium and phosphorus on plant growth - manufacture of urea, muriate potash and triple superphosphate. Complex fertilizers, mixed fertilizers & biofertilizers - their composition. Micronutrients - their role in plants.

Manures : Bulky organic manures - Farm yard manure - oil cakes- blood meal - fish manures- Composting process - handling and storage

UNIT II Pesticides (12 hrs.)

Pesticides – Definition- Classification of Pesticides based on the use and chemical composition - examples - general methods of application - Benefits of pesticides- Potential hazards. Safety measures -first aid.

Insecticides : Plant products – Nicotine, pyrethrin - Inorganic pesticides – borates. Organic pesticides - D.D.T. and BHC.

Fungicide : Sulphur compounds, Copper compounds, Bordeaux mixture.

Herbicides : Acaricides - Rodenticides. Attractants - Repellants.

UNIT III origin of soil **(12 hrs.)**

Soil: Origin of soil- definition of soil-rock system-weathering of rocks and minerals- main components of soil-organic, inorganic constituents-soil formation – factors favouring soil formation.

UNIT IV Characteristics of soil **(12 hrs.)**

Characteristics of soil: Physical aspects-soil texture- pore space-bulk density, particle density-soil colour-surface area-soil colloids-plasticity, shrinkage-flocculation and deflocculation,soil air, soil temperature and their importance in plant growth.
Acid, alkaline and saline soils-diagnosis- Methods of reclamation and after care.

UNIT V Soil testing **(12 hrs.)**

Soil testing: concept and objectives - soil sampling , tools, collection, processing, dispatch of soil sample.Estimation of total organic compound, available nitrogen and phosphorus in the soil sample.Determination of pH, EC, moisture content, bulk density and particle density of the soil sample.

References

1. A text book of Soil Science – Daji.A, Asia Publishing House, Madras 1970.
2. Textbook of soil Chemical Analysis – Hesse,P.R.A John Murray Newyork,1971.
3. Textbook of Soil Science - Biswas,T.D and Mukherjee,S.K.Second edition, Tata McGraw-Hill Education.
4. Chemistry for Agriculture and Ecology-Y.MidoM.Satake, Discovery Publishing House.
5. Soil Fertility &Fertilisers – Samuel L.Tisdale,Werner L. Nelson, James D.Beaton, John L. Havlin. Fifth edition, Macmillan.
6. Nature and properties of soils - Harry, O Buckman N Yle C. Brandy, Macmillan.
7. Insecticides, Pesticides and Agro based Industries –R.C.Paliwal, K.Goel, R.K.Gupta, Small Business Publications.

COURSE OUTCOME MAPPING

	UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5
CO1	L3	L3	L2		
CO2	L2	L2	L1		
CO3	L3	L3		L2	L2
CO4	L3	L3	L1	L1	L3

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

MAJOR ELECTIVE – 1- ANALYTICAL CHEMISTRY

Course Objectives

Course code – HCHEA		
Credits	**Hours**	**Course**
4	**60**	**Elective**

1. To give an in-depth understanding of water quality parameters, ground water and surface water pollution and its control measures.
2. To understand an overview about various types of fuels and its properties, analysis and combustion process
3. To learn about the theory of analytical chemistry
4. To learn about the causes and minimization of experimental errors
5. To know about the principle and applications of various thermal and spectro analytical techniques
6. To have an idea about the principle of colorimetric and gravimetric analysis

Course prerequisites

1. Students must study chemistry as one of the subjects in higher secondary level.

Course Outcomes:

Upon successful completion of the course, the students will be able to

1. Learn the concept of data analyze and analytical tools
2. categorize the types and significance of analysis
3. identify the most appropriate technique for a specific analysis

Unit I Errors and Data Analysis (12 hrs.)

Definition and explanation with examples of the terms – mean, median, mode, range, deviation, mean deviation, relative mean deviation, standard deviation, coefficient of variation and variance – accuracy and precision – types of errors – random and systematic errors – methods of detection and elimination of systematic errors – student's t-test – confidence levels – Q-test for rejection of result – curve fitting – method of least squares – significant figures and computational rules.

Unit II Water Analysis (12 hrs.)

Sampling and preservation of water samples – physical examination of water : color, odour, turbidity, taste and electrical conductivity – chemical characterisation : pH, acidity, alkalinity, TDS, total, temporary, permanent, calcium and magnesium hardness,

chloride, fluoride, BOD, COD, detergents and pesticides – residual chlorine and chlorine demand – Bacteriological examination : total and faecal coliforms.

Unit III Fuel Analysis (12 hrs.)

Solid fuels : coal – classification – proximate analysis : moisture content, ash content, volatile matter and fixed carbon – ultimate analysis : carbon, hydrogen, nitrogen, sulphur and oxygen – heating values – grading of coal – comparison of coal and coke – liquid fuels : flash point, aniline point, octane number and carbon residues – gaseous fuels : producer gas and water gas – calorific values.

Unit IV Electroanalytical Techniques (12 hrs.)

Electrogravimetry : principle, instrumentation and applications. Coulometry : constant current coulometry – coulometric titrations – applications – potentiostatic coulometry – Polarography : principle – experimental assembly – working – advantages and disadvantages of DME – applications to qualitative and quantitative analysis. Amperometric titrations : theory – apparatus – general procedures – applications – advantages

Unit V Spectroanalytical and Thermoanalytical Method (12 hrs.)

Spectroanalyticalmethods : principle, instrumentation and applications of colorimetry, spectrophotometry and fluorimetry – light scattering techniques: nephelometry and turbidimetry.

References

1. D.A.Skoog, D.M.West and Holler, Analytical Chemistry : An introduction, 6th Ed., Saunders College Publising,1978.
2. Gary D. Christian, Analytical Chemistry, 6th Ed., John Wiley & Sons, 1972.
3. S.M.Khopkar, Environmental Pollution Analysis, 1st Ed., Wiley Eastern Ltd.,1998.
4. APHA, Standard Methods for Estimation of Water and Waste water, 19th Ed., American Public Health Association, 2007.
5. O.P.Vermani and A.K. Narula, Applied Chemistry, 2nd Ed., New Age International Publishers, 2001.

6. A.K.Shaha, Combustion Engineering and Fuel Technology, Oxford & IBH Publising Company,1975.
7. D.A.Skoog, Holler and Nieman, Principles of Instrumental Analysis, 5th Ed., Saunders College publishing, 1996.
8. Hobart H.Willard, Lynne L.Merritt, John A.Dean and Frank A. Settle, Instrumental Methods of Analysis, 7th Ed., CBS Publishers & Distributors Pvt. Ltd., 2008.

COURSE OUTCOME MAPPING

	UNIT 1	**UNIT 2**	**UNIT 3**	**UNIT 4**	**UNIT 5**
CO1	**L2**	**L2**	**L2**	**L2**	**L2**
CO2	**L3**	**L1**	**L2**		
CO3	**L2**	**L2**	**L2**	**L3**	**L3**

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

MAJOR ELECTIVE – 1- PHARMACEUTICAL CHEMISTRY

Course code – HCHEB		
Credits	**Hours**	**Course**
4	**60**	**Elective**

Course Objectives

1. To understand the concepts and terminologies of pharmaceutical chemistry
2. To know the mechanism of action and metabolism of drugs
3. To study the functions of various drugs
4. To know the important diseases and their treatment
5. To study the common diseases and important disorders of human beings and the drugs used in the treatment.

Course prerequisites

1. Students must study chemistry as one of the subjects in higher secondary level.

Course outcomes

Upon successful completion of the course, the students will be able to

1. know the important Terminologies, Classification and Assay of different class of drugs.
2. understand the drug metabolic pathways, adverse effect and therapeutic value of drugs
3. acquaint well with the synthesis of some important class of drugs.
4. understand the chemistry of synthetic and natural drugs with respect to their pharmacological activity.
5. acquire knowledge in the chemotherapy for cancer and antihypertension drugs, antianginal agents hypoglycemic drugs.
6. help in correlating between pharmacology of a disease and its mitigation or cure.

Unit I Important Terminologies, Classification and Assay (12 hrs.)

Important terminologies - Pharmacology, Molecular pharmacology, Pharmacophore , metabolites, Antimetabolites, Pharmacokinetics, Pharmacodynamics, Bioavailability, Pharmacognosy, Pharmacotherapeutics, Toxicology, Chemotherapy – Classification of drugs – nomenclature of drugs – nonproprietary names – sources of drugs – assay of drugs (biological, chemical, immunological)

Unit II Mechanisms, Metabolisms and Medicinal Plants (12 hrs.)

Mechanism of drug action – absorption, drug delivery, drug excretion – Metabolism of drugs – chemical pathways of drug metabolism – phase – I (oxidative, reductive and hydrolytic reactions) and phase - II (conjugate reactions). Physiological effects of different functional groups in drugs –biological role of Na, K, Ca, Cu, Zn and iodine.

Indian medicinal plants – Phytoconsituents and their biological actions in Tulsi, neem, Keezhanelli, adathode, thoothuvalai

Unit III Drugs and their actions (12 hrs.)

Analgesics- narcotic analgesics- analgesic action, uses and structure activity of morphine.Non-narcotic analgesics –aspirin and paracetamol. Anaesthetics- local anesthetics –procaine- General anaesthetics- chloroform and halothane. Antibiotics – Therapeutically values of penicillin, tetracycline, chloramphenicol and streptomycin. Sulpha drugs – sulphanilide, sulphadiazine and cotrimoxazole. Antiseptics and disinfectants – phenols, chloramines and organicmercurials. Antidepressants – barbiturates – mechanism of action and uses.Antipsychotic drugs – piperazine and benzamides.

Unit IV Diseases and treatment (12 hrs.)

Composition of blood – blood grouping and matching – Rh factor. Aneaemia – causes and control – antianemic drugs. Blood pressure – causes, control and treatment-antihypertension drugs, antianginal agents - cardiovascular drugs, cardiac glycosides, vasodilators (one example for each). Diabetes – causes and control – hypoglycemic drugs – insulin – oral hypoglycemic drugs (tolubutamide and chlorpropamide). Cancer-causes and treatment – cobalt therapy - antineoplastic drugs (chlorambucil, methotrexate, plant products and hormones).

Unit V Common disorders and health care medicines (12 hrs.)

Common diseases – causes and treatment of insect borne diseases (Malaria and Filariasis), airborne diseases (Diptheria, Whooping cough, Influenza, common cold, TB) and Water borne diseases (Cholera, Typhoid and Dysentery).Digestive disorder – Jaundice.Respiratory disorder – Asthma.Nervous system disorder – epilepsy. Other

diseases – Leprosy.Health care medicines – Sources and deficiency diseases of Vitamins A, B complex, C, D, E and K.

References

1. A text book of pharmaceutical chemistry, Jayashree ghosh, S. Chand, 2003.
2. Pharmaceutical Chemistry by S. Lakshmi, Sultan Chand & Sons, 3rd edition (2004).
3. Medicinal Chemistry, A. shutoshkar, New Age International, 1992
4. Pharmaceutical chemistry – G.R. Chatwal.
5. Pharmacology and Pharmatherapeutics – R.S. Satoskar and S.D. Bhandarkar.
6. Drugs , G.L.D. Krupadanam, D.V. Prasad, K.V.Rao, K.L.N.Reddy and C.Sudhakar, Tata McGraw- Hill Publishing Company,New Delhi.
7. Medicinal chemistry, G.R.Chatwal, Himalaya Publishing House, New Delhi (2002).

COURSE OUTCOME MAPPING

	UNIT 1	**UNIT 2**	**UNIT 3**	**UNIT 4**	**UNIT 5**
CO1	**L3**		**L2**	**L1**	**L1**
CO2		**L3**	**L2**	**L2**	**L2**
CO3			**L3**	**L3**	
CO4			**L2**	**L2**	
CO5		**L1**	**L2l**	**L3**	
CO6	**L1**	**L2**	**L2**		**L3**

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

MAJOR PRACTICAL

PHYSICAL CHEMISTRY PRACTICAL – I

Course code – HCHL51		
Credits	**Hours**	**Course**
2	**60**	**Practical**

Course Objectives

1. To create knowledge about colligative properties and binary mixtures of the system
2. To provide training in Freundlich isotherm and phase equilibrium of the chemical reaction
3. To improve the knowledge of the rate of chemical reactions.
4. To acquire the knowledge of electro chemical aspects like conductometric and potentiometric titrations
5. To correlate the theoretical principles with practical experiments of physical chemistry.

Course Prerequisites

1. Students must study chemistry as one of the subject in higher secondary level.

Course Outcomes

At the end of the course the student will be able to

1. Know the principle of both electrical and non-electrical physical practicals.
2. Learn the concept of phase equilibria.
3. Determine the molecular mass of the substance
4. Measure eutectic temperature and follow kinetics of reaction.
5. Perform conductometric and potentiometric titrations for calculating unknown concentration

Practicals

I. Molecular mass determination

1. Determination of molar mass of the given substance by Rast micro/macro method.
2. Determination of molecular weight of the given substance by Transition temperature method.

II. Phase diagram

3. Determination of CST of phenol-water system.
4. Study of phase equilibrium – Simple eutectic.

III. Conductometric Titration

5. Estimation of HCl by conductometric method with link NaOH

IV. Potentiometric titrations

6. Estimation of Fe(II) by potentiometric method using standard ferrous ammonium sulphate (to be prepared) and link $KMnO_4$.

V. Kinetics

7. Study of adsorption of oxalic acid on charcoal and verification of Freundlich isotherm

References

1. J.N. Gurthu and R. Kapoor, Advanced Experimental Chemistry, S. Chand and Co., 1987.
2. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt., 1996.
3. avid P. Shoemaker, Carl W. Garland, Joseph W. Nibler, Experiments in Physical Chemistry, 5th Edi., McGraw- Hill Book company, 1989.
4. Alexander Findlay and J.A. Kitcher.Practical Physical Chemistry, Longmans
5. Y.B. Yadav, Practical Physical Chemistry, Goel publishing house

COURSE OUTCOME MAPPING

	EXPT 1	**EXPT 2**	**EXPT 3**	**EXPT 4**	**EXPT 5**
CO1	**L2**	**L2**	**L2**	**L2**	**L2**
CO2		**L3**			
CO3	**L3**				
CO4		**L3**			**L3**
CO5			**L3**	**L3**	

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

PHYSICAL CHEMISTRY PRACTICAL – II

Course code – HCHL52		
Credits	**Hours**	**Course**
2	**60**	**Practical**

Course Objectives

1. To improve the knowledge of the rate of chemical reactions with comparing strength of acids.
2. To provide training in the determination of critical solution temperature and strength
3. To acquire the knowledge of electro chemical aspects like conductometric and potentiometric titrations
4. To correlate the theoretical principles with practical experiments of physical chemistry.

Course Prerequisites

1. Students must study chemistry as one of the subject in higher secondary level.

Course outcome

At the end of the course the student will be able to

1. Know the principle of both electrical and non-electrical physical practicals.
2. Measure the rate constants of the reaction.
3. Perform conductometric and potentiometric titrations for calculating unknown concentration

Course Outline

I. Kinetics

1. Ester hydrolysis- Comparison of the strengths of acids

II. Conductometric titration

2. Estimation of $MgSO_4$ by conductometric method using standard $MgSO_4$ (to be prepared) and link $BaCl_2$
3. Determination of equivalent conductance of weak electrolyte and calculation of dissociation constant
4. Estimation of CH_3COOH by conductometric method using standard oxalic acid (to be prepared) and link NaOH

III. Potentiometric titrations

5. Estimation of Fe(II) by potentiometric method using standard ferrous ammonium sulphate (to be prepared) and link $K_2Cr_2O_7$.

References

1. J.N. Gurthu and R. Kapoor, Advanced Experimental Chemistry, S. Chand and Co., 1987.
2. Sundaram, Krishnan, Raghavan, Practical Chemistry (Part II), S. Viswanathan Co. Pvt., 1996.
3. David P. Shoemaker, Carl W. Garland, Joseph W. Nibler, Experiments in Physical Chemistry, 5th Edi., McGraw - Hill Book company, 1989.
4. Alexander Findlay and J.A. Kitcher, Practical Physical Chemistry, Longmans
5. Y.B. Yadav, Practical Physical Chemistry, Goel publishing house

COURSE OUTCOME MAPPING

	EXPT 1	**EXPT 2**	**EXPT 3**
CO1	**L2**	**L2**	**L2**
CO2	**L3**		
CO3		**L3**	**L3**

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

Skill Based Subject (1 Course)- HSBC51

Effective Communication / Personality Development

SEMESTER – VI

SKILL BASED CORE – II- CHROMATOGRAPHY

Course code – HCHSC3		
Credits	**Hours**	**Course**
4	**60**	**SBC**

Course Objectives

1. To understand concept of paper chromatography.
2. To know factors affecting R_f values, choice of adsorbents and solvents.
3. To know stationary and mobile phases in the column chromatography
4. To distinguish ion exchange resins & their types in Ion Exchange Chromatography
5. To learn the principles and applications of Gas Chromatography.

Course Prerequisites

1. Students must study chemistry as one of the subject in higher secondary level.

Course Outcomes

At the end of the course the student will be able to

1. Learn the concept of chromatography
2. Understand the principle involved in chromatography
3. Generalize the adsorbents/eluents in thin layer chromatography.
4. Acquire knowledge about various stationary and mobile phases
5. Sketch the instrumentation setup and operating procedure for chromatography.

Unit I Paper Chromatography (12 hrs.)

Introduction, Classification of chromatography methods.

Paper Chromatography: Principles, significance of R_f values. Experimental procedures, choice of paper and solvent systems, developments of chromatogram.Detection of the spots.Ascending, descending and radial Paper Chromatography Two-dimensional chromatography.Applications.

Unit II Thin Layer Chromatography (12 hrs.)

Thin Layer Chromatography:Advantages of thin layer chromatography – principles, factors affecting R_f values. Experimental procedures.Choice of adsorbents and solvents.Preparation of plates.Development of the chromatogram.Detection of the spots.Applications.

Unit III Column Chromatography (12 hrs.)

Column Chromatography – Principles, experimental procedures, stationary and mobile phases,Choice of solvent systems. Separation technique.Applications.

Unit IV Ion Exchange Chromatography (12 hrs.)

Principle, ion exchange resins & their types- cation exchange resins, anion exchange resins, ion exchange reactions, ion exchange equilibria properties of ion exchange resins, ion exchange capacity and applications.

Unit V Gas Chromatography (12 hrs.)

Principle, instrumentation, choice of injectors, column and detectors – Programmed temperature chromatography, flow programming chromatography, gas-solid chromatography and hyphenated techniques in chromatography – Applications of Gas Chromatography.

References

1. B. Fried, J. Sharma: Thin-Layer Chromatography, Fourth Edition, revised and
2. expanded, Marcel Dekker Inc.,New York – Basel,2005.
3. Scott, R. P. W. Techniques and Practices of Chromatography; 2nd ed. Marcel Dekker Inc., New York,1995
4. Hinshaw, J. V. Ettre, L. S. Introduction to Open Tubular Column Gas Chromatography; Advanstar,1989.
5. Poole, C. F. Poole, S. K. Chromatography Today; Elsevier, 1991.
6. HPLC: Analytical Chemistry by Open Learning John Wiley & Sons, New York, (1991).

COURSE OUTCOME MAPPING

	UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5
CO1	L2	L2	L2	L2	L2
CO2	L2	L2	L2	L2	L2
CO3	L1	L1	L1	L1	L1
CO4	L1	L1	L1	L1	L1
CO5				L1	L3

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

SKILL BASED CORE – II- DAIRY CHEMISTRY

Course Objectives

1. To learn the composition and properties of milk
2. To understand the chemical composition of milk and milk processing.
3. To know the chemistry of cream and butter
4. To study to fermented milk products
5. To know the condensed milk and dairy detergents

Course code – HCHSC4		
Credits	**Hours**	**Course**
4	**60**	**SBC**

Course Prerequisites

1. Students must study chemistry as one of the subject in higher secondary level.

Course Outcomes

At the end of the course the student will be able to

1. Identify the various constituents and properties of milk.
2. understand the various processes of milk.
3. analyze the milk products.
4. measure the growth and development of fermented and condensed milk products.

Unit I Properties of milk (12 hrs.)

Definition, Composition, Milk lipids, Milk proteins, vitamins and minerals. Factors affecting the composition of milk - adulterants, preservatives, and neutralizer - examples and their detection.

Unit II Processing of milk (12 hrs.)

Destruction of microorganisms in milk – physicochemical changes during processing – boiling, pasteurization – pasteurization types – bottle pasteurization – batch pasteurization – HTST (High Temperature Short Time) – vacuum pasteurization – (UHT) Ultra High Temperature Pasteurisation.

Unit III Milk products-I (12 hrs.)

Milk Products: Cream – definition, classification – manufacturing – chemistry of creaming process –72hysic–chemical properties – separation of cream , estimation of fat in cream , Butter – definition, classification, composition, theory of churning,

desibutter, salted butter. Ghee –major constituents, common adulterants and their detection.

Unit IV Milk products-II (12 hrs.)

Fermented milk products - fermentation of milk - definition and conditions. Ice creams - definition, composition, types, manufacture of ice - cream, stabilizers, emulsifiers, and their role, milk powder – definition, process of making milk powder.

Unit V Condensed milk and dairy detergents (12 hrs.)

Condensed milk – definition, classification and differences between condensed milk and skim – condensed milk – sanitation – pasteurization – nutritive value of milk – difference between cow milk and bauffalo milk- milk enzymes. Dairy Detergents : Definition-characteristics – classification-washing procedure (modern method) sterilization – chloramine -T and hypochlorite solution.

References :

1. Applied Chemistry-K.BagavathiSundari MJP Publishers Chennai. 2006.
2. Principles of dairy technology – Robert Jenness, Wiley, New York,2001.
3. Indian Dairy Products - Rangappa and Acharya, K.T. Asia Publishing House, Bombay, India,1999.
4. Fundamentals of Dairy chemistry –Wond. F.P. Springer,2000.
5. Outlines of Dairy Technology – Sukumar De. – Oxford University Press,1997.
6. Applied chemistry for home science & allied science –T.Jacob, Mcmillan,2005.

COURSE OUTCOME MAPPING

	UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5
CO1	L3	L1	L1	L1	L1
CO2	L1	L3	L1	L1	L1
CO3			L3	L3	L2
CO4				L3	L3

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

MAJOR ELECTIVE – II- POLYMER CHEMISTRY

Course code – HCHEC		
Credits	**Hours**	**Course**
4	**60**	**Elective**

Course Objectives

1. To know the concept of polymerization and types of polymers
2. To understand the characteristics of polymers
3. To acquire knowledge about the polymerization techniques and polymer processing
4. To know the chemistry of individual polymers
5. To have an idea about the recent advances in polymer sciences

Course Prerequisites

1. Students must study chemistry as one of the subject in higher secondary level.

Course Outcomes

At the end of the course the student will be able to

1. Recall the concept of polymers
2. Learn the classification/techniques of polymers
3. Identify the industrially important polymers
4. List out the application of polymers inn various fields

Unit I Introduction to polymers (12 hrs.)

i. Definition - Monomer, polymer and polymerisation - classification of polymers.)
ii. Physical properties and applications - Rubbers, plastic, fibres
iii. Thermal response - thermoplastics, thermosetting
iv. Structure - Homopolymers, Copolymers
v. Mode of formation - Addition, Condensation Polymerisation (definition and examples only)
vi. Methods of polymerization - Bulk, Solution, Suspension Polymerisation (definition and examples only)
vii. Chemistry of polymerization: Chain polymerization, free radical, ionic, co-ordination, step polymerization, polyaddition and polycondensaion, miscellaneous ring opening and group transfer polymerizations.

Unit II Characteristics of polymers (12 hrs.)

Glass transition temperature (Tg) - definition – Factors affecting Tg – relationships between Tg and molecular weight and melting point. Number average, weight average (problems), sedimentation and viscosity average molecular weights - degree of polymerization, vulcanisation. Polymer degradation - basic idea of thermal, photo and oxidative degradation of polymers.

Unit III Polymerization techniques and processing (12 hrs.)

Bulk, solution, suspension, emulsion, melt condensation and interfacial poly condensation polymerizations. polymer processing - calendaring - die-casting, rotational casting - compression moulding - injection moulding - blow moulding - extrusion moulding and reinforcing.

Unit IV Chemistry of some commercial polymers (12 hrs.)

i. Thermoplastics, polyethylene, polypropylene, polystyrene, polyacrylonitrile, polyvinyl chloride, nylon, polyester.
ii. Thermosetting plastics: Phenol formaldehyde resin, urea formaldehyde resin, melamine formaldehyde, epoxy resin, polycarbonate.
iii. Elastomers: Natural rubber and synthetic rubber, Styrene and neoprene rubber.

Unit V Advances in polymer (12 hrs.)

Biopolymers - contact lens, dental polymers, artificial heart, kidney, skin and blood cells, Polymer industries in India.

Books for References:

1. V.R. Gowarikar, N.V. Viswanathan and J. Sreedhar. Polymer Science, Wiley Eastern, 1995.
2. F.N. Billmeyer, Textbook of Polymer Science, Wiley Interscience, 1971.
3. Material Science II edition, P.K. Palanisamy SCITECH Publications India Pvt., Ltd., Chennai-600001.
4. Engineering Chemistry, V Srinivasan, S.D. Uma Maheshwari, M. Meena. SCITECH Publications India Pvt., Ltd., Chennai- 600001.

5. Introduction to Organic Chemistry. John McMurry Brooks/coleCenage Learning India Private Limited. First Reprint, 2008.
6. Modern Chemistry, David. W. Oxtoby, H.P. Gills, Alan Campion Brooks/coleCenage Learning India Private Limited. First Reprint 2008.

COURSE OUTCOME MAPPING

	UNIT 1	**UNIT 2**	**UNIT 3**	**UNIT 4**	**UNIT 5**
CO1	**L3**	**L3**		**L2**	
CO2	**L3**	**L1**	**L3**	**L1**	
CO3	**L1**		**L1**	**L3**	**L3**
CO4	**L1**			**L3**	**L3**

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

MAJOR ELECTIVE – II- INDUSTRIAL CHEMISTRY

Course Objectives

Course code – HCHED		
Credits	**Hours**	**Course**
4	**60**	**Elective**

1. To gain knowledge about systems of units and conversion factor
2. To understand utilities in chemical industries
3. To know the severity of corrosion and methods of preventing it
4. To study the industrial process of silicate industry
5. To acquire the knowledge about the unit process

Course Prerequisites

1. Students must study chemistry as one of the subject in higher secondary level.

Course Outcomes

At the end of the course the student will be able to

1. Learn the fundamental in manufacturing processes
2. Familiarizes the methods/strategies in manufacturing processes
3. Asses the advantages and limitations of various industrial process.

Unit I Cement (12 hrs.)

Introduction-Cement manufacturing process, chemical composition of various types cement, chemical characteristics of cement raw materials and their phase relation, various unit operation of cement manufacture.

Hydration of clinker minerals, role of gypsum in cement hydration process, hydration of Portland and strength of Portland cement.

Unit II Fuels and furnaces (12 hrs.)

Fuels - types of fuels - calorific values - ignition point - pyrometric effect - explosives range - Flue gas analysis by Orsat's method - explosives - classifications - low explosives - `initiating explosives – high explosives - rocket propellants - nuclear fuels.

Furnaces - types of furnaces - Kilns - Blast furnace, reverberatory furnace - muffle furnace - electric furnace - regenerative furnace, open hearth furnace - Bessemer converter - vertical retort furnace.

Unit III Corrosion and protective coating (12 hrs.)

Introduction - severity of corrosion - chemical and electrochemical corrosion - mechanism - factors influencing corrosion - control of corrosion - cathodic and anodic protection.

Paints - characteristics of paint - constituents of paints - pigments - vehicles - thinners - driers - fillers - plasticizers - anti skinning agents - their function and properties.

Metallic coating - removal of surface contamination - removal of superficial corrosion products - polishing - galvanizing - tinning - electroplating.

Unit IV Silicate industry (12 hrs.)

Refractories - requirements of refractories - properties of refractories – solid refractories - fire clay refractories - magnesite refractories, dolomite bricks, graphite refractories, zirconia refractories, silicon carbide.

Abrasives - classifications – natural (diamond, corundum, emery, garnet, quartz and flint) and artificial (carborundum, alundum, boron carbide, metallic abrasives). Uses of abrasives - cement manufacture - setting and hardening of cements - gypsum - plaster of Paris - manufacture – setting and hardening - uses. White wares manufacture - types – glazing.

Unit V Unit processes in organic manufacture (12 hrs.)

Sulphonation - uses and applications of sulphonates and sulphates - sulphonating agents - sulphur trioxide. Hydrolysis - hydrolyzing agents - mechanism of hydrolysis.

Oxidiation - oxidizing agents - permanganate and dichromate – liquid phase oxidation -vapour phase oxidation - commercial manufacture of acetic acid. Hydrogenation - catalysts for hydrogenation - hydrogenation of vegetable oils.

References

1. Industrial Chemistry, B. K. Sharma, Goel Publishing House, Meerut, 2005.
2. Industrial Chemistry, B. N. Chakrabarthy, Oxford & IBH Publishing Co. Pvt. Ltd. Calcutta, 2000.
3. Unit Processes in Organic Synthesis, P. H. Groggins, Tata McGraw-Hill Publishing Company limited, New Delhi,1992.

COURSE OUTCOME MAPPING

	UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5
CO1	L2	L2	L2	L1	L2
CO2	L1	L3	L3	L3	L1
CO3	L3	L3	L3	L2	L2

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

INTERNSHIP PROJECTS

Hours	Credits	Course
23	13	Projects

The B.Sc VI semester is allotted for Internship Project, 23 hours and 13 credits per week is allotted for this purpose. Students may select the Industry for their Internship project. Industry may be small scale and private limited industries. Such as Tuticorin spic, Tarangedhara chemicals industry, Milk Industry, Pencil and Rubber Manufacture, Soap Industry etc. Students select one guide from industry and one guide from the department. At the end of the project, both guides are jointly submitting the report.

ALLIED CHEMISTRY – I

Course code - HCHA11/ HCHA31		
Credits	**Hours**	**Course**
3	**45**	**Allied**

Course Objectives

1. To study the nature of inert gases and their compounds
2. To learn the chemistry of basic heterocyclic compounds.
3. To study about photochemical reactions
4. To learn about the importance of polymers and polymer science.
5. To study about lubricants and some cosmetics in the modern world.

Course Prerequisites

1. Students should have studied chemistry in Higher Secondary Education.

Course Outcomes

At the end of the course, the student will be able to:

1. Remember the various concepts of zero group elements, basic reactions, polymer and photochemistry in higher secondary sections
2. Understand the various topics in chemistry in-depth.
3. Analyze the importance of chemistry in day-to-day life.
4. Evaluate the significance of basic concepts in chemistry
5. Design the application part using the acquired knowledge.

Unit I Inorganic chemistry - Zero group elements (9 hrs.)

Isolation of inert gases by physical and chemical methods - preparation and properties of xenon tetra fluoride, xenon hexafluoride xenon oxytetrafluoride - uses of noble gases – clathrates and their uses.

Unit II Organic chemistry – Principles of reactions (9 hrs.)

Heterolytic and homolytic cleavage - nucleophiles and electrophiles - reaction intermediates – preparation and properties of carbonium ions, carbanions and free radicals -type of reactions - substitution, addition, elimination and polymerisation reactions.

Unit III Physical chemistry - Photochemistry (9 hrs.)

Definition - comparision between thermal and photochemical reactions - Laws of photochemistry-Beer Lambert's law-Grothus Draper law-Einstein's law-Quantum yield-low and high quantum yields - determination of quantum yield-fluorescence,

phosphorescence, thermoluminescence, chemiluminescence and bioluminescence-definition with examples-photosensitisation

Unit IV Polymer Chemistry (9 hrs.)

Definition - Monomers, Oligomers, Polymers - Classification of polymers-: Natural synthetic, linear, cross linked and network- plastics, elastomers, fibres, Homopolymers and Co-polymers

Thermoplastics- Polyethylene, Polypropylene, polystyrene, Polyacrylonitrile, Poly vinyl Chloride, nylon and polyester - Thermosetting plastics -: Phenol formaldehyde and epoxide resin-Elastomers- Natural rubber and synthetic rubber - Buna - N, Buna-S and neoprene.

Unit V Applied Chemistry (9 hrs.)

Lubricants – classification-criteria of good lubriacting oils-synthetic lubricating oils-poly glycols and poly alkene oxides-greases or semi solid lubricants – examples-solid lubricants-graphite.

Preparation and uses of shampoo, nail polish, sun screens, tooth powder, tooth paste, boot polish, moth ball, chalk piece.

References

1. B. R. Puri, L. R. Sharma and K. C. Kalia, Principles of Inorganic Chemistry,1978.
2. P. L. Soni, Text Book of Inorganic Chemistry,1987.
3. K. S. Tewari and N. K. Vishnoi,A Text Book of Organic Chemistry,1991.
4. Arun Bahl and B.S. Bahl, Advanced Organic Chemistry, S. Chand and Sons,1998.
5. M.K. Jain and S. C. Sharma, Modern Organic Chemistry,2007.
6. K.K.Rohatgi Mukherjee, Fundamentals of photochemistry , Wiley Eastern Ltd,1996.
7. B.R. Puri and L.R. Sharma, Principles of Physical Chemistry, chand& Co,2000.
8. Malcom P. stevens, Polymer Chemistry – An Introduction,2001.
9. V.R. Gowariker, Polymer Science, Wiley Eastern, 1995.
10. Sawyer.W, Experimental cosmetics,Dover publishers, New york, 2000.

COURSE OUTCOME MAPPING

	UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5
CO1	L2	L2	L2	L2	
CO2	L1	L1	L1	L2	L2
CO3			L2	L3	L3
CO4			L2	L3	L3
CO5	L2	L2	L2	L2	L1

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

Allied Practicals - I
Quantitative Analysis

Course Objectives

1. To provide training in basic volumetric titrations like acidimetry, alkalimetry, permanganometry, iodometry, dichrometry and complexometry.

Course code –HCHAL1/ HCHAL3		
Credits	**Hours**	**Course**
2	**60**	**Practical**

Course Prerequisites

1. The students should have the basic knowledge of practicals in Higher Secondary School.

Course Outcomes

At end of the course, the students will be able to,

1. Remember the volumetric estimation procedure.
2. Understand how to estimate the metal ions in the given solution.
3. Apply to the principle in estimating the unknown samples.

Practicals

I. Acidimetry and alkalimetry
   a. Estimation of oxalic acid – Std oxalic acid
   b. Estimation of Na_2CO_3 – Std Na_2CO_3

II. Permanganometry
   a. Estimation of ferrous ammonium sulphate – Std ferrous ammonium sulphate

III. Iodometry
   a. Estimation of $K_2Cr_2O_7$ – Std $K_2Cr_2O_7$

IV. Dichrometry
   a. Estimation of ferrous iron – Std ferrous ammonium sulphate

V. Complexometry
   a. Estimation of Zn – Std $ZnSO_4$
   b. Estimation of Mg – Std $ZnSO_4$

References

1. G.H.Jeffery, J.Bassett, J.Mendham and R.C.Denny 'Vogel's Text book of Quantitative Chemical Analaysis5th Edition,1978, ELBS.

COURSE OUTCOME MAPPING

	EXPT 1	EXPT II	EXPT III	EXPT IV
CO1	L2	L2	L2	L2
CO2	L3	L3	L3	L3
CO3	L2	L2	L2	L2

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

Allied Chemistry – II

Course code - HCHA21/ HCHA41		
Credits	**Hours**	**Course**
3	**45**	**Allied**

Course Objectives

1. To study about the properties of transition and inner transition elements
2. To learn the chemistry of basic aromatic compounds.
3. To understand the nuclear particles and few nuclear reactions
4. To know about carbohydrates, amino acids, proteins and nucleic acid.
5. To know about some common diseases and the drugs used.

Course Prerequisites

1. Students should have studied chemistry in Higher Secondary Education

Course Outcomes

At the end of the course, the student will be able to:

1. Remember the basic concepts of various branches in chemistry.
2. Understand the general characteristics of concepts.
3. Apply the applications of day-to-day life.
4. Analyse the concepts of biochemistry and pharmaceutical chemistry.
5. Evaluate the significance of nuclear chemistry and biochemistry

Unit I Inorganic Chemistry (9 hrs.)

Transition and Inner Transition elements

Transition Elements: - general characteristics - metallic character - oxidation states - size -density - melting and boiling points - ionization energy - colour - magnetic properties - reducing properties - catalytic properties.

Inner Transition elements:-Lanthanides - Electronic configuration and general characteristics - occurrence of lanthanides - separation by ion exchange method - lanthanide contraction. Actinides - Electronic configuration and general characteristics - comparison with lanthanides.

Unit II Organic Chemistry (9 hrs.)

Aromatic compounds

General characteristics of aromatic compounds - aromaticity - Huckel's rule with examples- non - benzenoid aromatic compounds (definition and examples only) Preparation, properties and structure of benzene, naphthalene and anthracene.

Unit III Physical Chemistry **(9 hrs.)**

Nuclear chemistry

Nuclear stability - n/p ratio - packing fraction - mass defect - binding energy - isotopes, isobars, isotones with examples. Separation of isotopes by diffusion method - group displacement law - radioactive series - Nuclear fission, fusion - Application of radio isotopes (radio diagnosis and therapy, C^{14} dating).

Unit IV Biochemistry **(9 hrs.)**

Carbohydrates - definition and classification - artificial synthetic sweeteners.Amino acids - classification - amphoteric nature - isoelectric point. Proteins - classification according to composition, solubility and shape - colour reactions -biological action .Nucleic acids - purines, pyrimidines, nucleocides, nucleotides - DNA - structure of DNA - RNA - different types of RNA

Unit V Pharmaceutical Chemistry **(9 hrs.)**

Common diseases - infective diseases - insect borne - air borne - water borne - hereditary diseases.Definition and examples of analgesics, antipyretics, sulpha drugs, antimalarials and, antibiotics. Diabetes - causes - hyper and hypoglycemic drugs. Indian medicinal plants - tulsi, neem, keezhanelli- their importance.

References

1. Puri, Sharma & Kalia, Principles of Inorganic Chemistry, Milestone Publishers and Distributors, 2008.
2. P.L. Soni, Text book of Inorganic Chemistry, Sultan Chand and Sons, 2007.
3. Bahl and Arun Bahl, Organic Chemistry, S. Chand and Sons, New Delhi , 2005.
4. Morrison & Boyd, Organic Chemistry, VIth ed, Prentice Hall of India Pvt. Ltd., New Delhi, 1998.
5. P. L. Soni, Text book of Organic Chemistry, S. Chand and Company Ltd., New Delhi
6. J. L. Jain, Sunjay Jain and Nitin Jain, Fundamentals of Biochemistry, S. Chand and Company Ltd.,New Delhi, 2005.
7. S. Lakshmi, Pharmaceutical Chemistry, S. Chand and Sons, New Delhi , 1995.

COURSE OUTCOME MAPPING

	UNIT 1	UNIT 2	UNIT 3	UNIT 4	UNIT 5
CO1	L2	L2	L2	L2	L2
CO2	L3	L3	L3	L2	L2
CO3			L1	L3	L3
CO4	L1			L3	L3
CO5			L3	L2	L2

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

Allied Practical - II

Organic Qualitative Analysis

Course code –HCHAL2/ HCHAL4		
Credits	**Hours**	**Course**
2	**60**	**Practical**

Course Objectives

1. To provide training in qualitative analysis of organic compounds like identification of functional groups, test for saturation and unsaturation and detection of elements, particularly nitrogen.

Course Prerequisites

1. Students must study chemistry as one of the subjects in higher secondary level.

Course Outcomes:

At the end of the course, the student will be able to:

1. Analyse the organic compounds
2. Identity the functional groups present in an organic compound.
3. Determine the yield of organic derivatives.
4. Create a method for the qualitative and quantitative analysis of organic compounds

Practicals

a. Detection of N, , S and halogen Qualitative analysis

b. Test for aliphatic and aromatic nature of substances.

c. Test for saturation and unsaturation.

d. Identification of functional groups

   i. Carboxylic acid
   ii. Phenols
   iii. Aldehydes
   iv. Ketones
   v. Carbohydrates
   vi. Primary amines
   vii. Amides

COURSE OUTCOME MAPPING

	EXPERIMENT 1
CO1	**L3**
CO2	**L3**
CO3	**L3**
CO4	**L3**

L1: Addressed to small extent

L2: Addressed significantly

L3: Addressed Major Part

Model Question

Industrial Chemistry– HCHED

Time: Three hours Maximum: 75 marks

Part A - (10×1=10 marks)

Answer **ALL** the questions

		Level	CO	PO
1	In clinkering zone has the temperature around --------	L2	**CO1**	**PO3**
2	What is the role of gypsum in cement hydration process?	L2	CO1	PO2
3	What is muffle furnace?	L2	CO2	PO2
4	Define Abrasive.	L1	CO2	PO2
5	What is electrochemical corrosion?	L1	CO1	PO2
6	Define electroplating?	L1	CO2	PO2
7	Write the chemical formula-plaster of paris	L2	CO1	PO2
8	What is solid refractories?	L1	CO2	PO2
9	List the primary applications of sulphonates	L1	CO3	PO2
10	What is liquid phase oxidation?	L1	CO1	PO3

Part B - (5×5 = 25 marks)

Answer **ALL** the questions choosing either (a) and (b)

			Level	CO	PO
11.	(a)	Write note on Setting of cement.	L2	CO2	PO4
		(OR)			
	(b)	Explain the Wet Process of Manufacturing of Cement.	L3	CO2	PO4
12.	(a)	Explain blast and reverberatory furnace.	L2	CO2	PO2
		(OR)			
	(b)	Classify Explosive in detail.	L2	CO1	PO2

13.	(a)	What are the characteristics of paints?	L2	CO1	PO2
		(OR)			
	(b)	How electroplating can be done to prevent corrosion?	L3	CO2	PO4
14.	(a)	What are the basic requirements and propertiesof refractoriness?	L2	CO1	PO2
		(OR)			
	(b)	Classify refractoriness.	L2	CO1	PO2
15.	(a)	Explain about Catalysis for hydrogenation	L2	CO3	PO7
		(OR)			
	(b)	Define sulphonation. Write the uses and application of sulphonates	L2	CO3	PO7

PART C - (5 x 8= 40 marks)

Answer **ALL** the questions choosing either (a) or (b).

			Level	**CO**	**PO**
16.	(a)	Write the Types of Cement and its uses	L2	CO2	PO4
		(OR)			
	(b)	Comment the Manufacturing process of Cement by Dry method.	L3	CO2	PO4
17.	(a)	Compare open hearth furnace, Bessemer converter furnace and regenerative furnace	L4	CO2	PO3
		(OR)			
	(b)	Briefly explain about the fuel analysis by orsat's method	L3	CO2	PO3
18.	(a)	Compare wet corrosion and dry corrosion.	L4	CO1	PO4
		(OR)			
	(b)	List out the factors influencing corrosion and how it is controlled.	L4	CO3	PO8
19.	(a)	Write note on magnesite, dolomite, zirconia and silicon carbide	L2	CO2	PO3
		(OR)			
	(b)	How abrasives are manufactured? Classify its types.	L2	CO2	PO3
20.	(a)	Compare liquid phase oxidation and vapour phase oxidation.	L3	CO3	PO5
		(OR)			
	(b)	Define hydrolysis. Write the mechanism of hydrolysis	L2	CO3	PO5