Bagalkot University,

(A State Public University of Govt. of Karanataka)

Jamkhandi

The Draft

SCHOOL OF BASIC SCIENCES
Department of Chemistry

for

M.Sc. degree in CHEMISTRY

REGULATIONS
&
SCHEME OF EXAMINATION

As per
CHOICE BASED CREDIT SYSTEM (CBCS)

Adapted from RCU Belagavi applicable from the Academic Year 2023-24

Preamble for PG Syllabus of Bagalkot University

Bagalkot University Jamkhandi has been established by the Government of Karnataka and has started functioning from the academic year 2023-24. All the degree colleges other than engineering and medical colleges in the district of Bagalkote, are affiliated to this university as per the Karnataka State Universities Act 2000, as modified by the 26th Act of 2022. The students taking admission to any of the colleges in the district of Bagalkote, from the academic year 2023-24 will be students of Bagalkot University. The Chancellor of the university, the honorable Governor of Karnataka, has instructed the Vice chancellor and the university to adapt, the rules and regulations of the parent university, Rani Channamma University, Belagavi for the immediate activities (Vide letter from the office of the Governor GS 01 BGU 2023 dated 17/05/2023).

In this connection, Bagalkot University has adapted the postgraduate syllabus from RCU, Belagavi for all the 2 years degree PG programmes such as M.A.(English), M.A.(Political Science), M.S.W.,M.Com, etc. The syllabus follows the Choice Based Credit System introduced by University and provides flexibility to the students to choose their course from a list of electives and soft-skill courses, which makes teaching-learning student-centric. The higher semester syllabi will be published in due course. The syllabus is being published as one electronic file for each degree and is self-contained. Only the subject codes/ question paper codes are changed, whereas the subject syllabi remains the same. The subject code format is described in the following.

Subject Code Format for M.A. (History) and M.Sc. (Physics)

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17
Ver	Uni. Code		DEGREE			SEM		DISCIPLINE			SUB. TYPE			SL. NO. IN DISC. & S. TYPE		TH/ LAB /B/I NT.
1	2	6	M	S	C	0	1	P	H	Y	C	S	C	0	1	T
1	2	6	M	A	M	0	1	H	I	S	C	S	C	0	1	T

[1]The Ver information gives the version of the syllabus. It can take values 1,2..9,a,b,…

[2-3] The University UUCMS Code

[4-6] The PG degree codes to be provided as

Sl. No	Degree Code	Degree
1	MSC	Master of Science
2	MAM	Master of Arts
3	MCM	Master of Commerce
4	MBA	Master of Business Administration
5	MCA	Master of Computer Applications
6	MSW	Master of Social Work
7	MED	Master of Education
8	MPE	Master of Physical Education

[7-8]The Semester Information is provided as

Sl. No	Semester
1	‘01
2	’02
3	03
….	

[9-11]The Discipline Information to be provided as

Sl No	Degree	Discipline Code
1	MCM-MCOM	XXX
2	MCA	XXX
3	MBA	XXX
4	MSW	XXX
5	MAM	‘HIS’,POL’,’KAN’, ‘ENG’
6	MSC	‘PHY’,’CHE’, ‘MAT’,
7	MED-MEd	XXX
8	MPE-MPEd	XXX

[12-14]The Subject Type to be provided as

Sl. No.	TYPE	Description
1	HCC	Hard Core Course
2	CSC	Core Subject Course
3	SCC/SPC/OPC	Soft Core Course /Specialization Course/ Optional Course
4	OEC	Open Elective Course

[15-16] The Running Serial Number is to be provided for a particular subject type 01 to 99

[17] This character specifies the category of the subject namely, T=theory, L-Lab, P-Project, I-Internship, B- Bothe theory and Lab

BAGALKOT UNIVERSITY, JAMKHANDI
DEPARTMENT OF CHEMISTRY

[SCHOOL OF BASIC SCIENCES]

Regulations & Scheme of Examination
for
M.Sc. Degree in Chemistry
as per under CBCS
(Adapted from RCU Belagavi applicable from the Academic Year 2023-24)

Title of the Course
The course shall be called **M.Sc. in CHEMISTRY**.

Duration of the course: The M.Sc. degree course is of two years duration, spread over four semesters each of four months duration.

Eligibility for Admission: The Bachelor's degree in Science or equivalent degree with Chemistry as one of the subject. The candidate should have obtained at least 40% of marks in optional subjects as well as in aggregate. Relaxation in respect of SC/ST/Cat -I etc. will be followed as per prevailing rules of the university.

Admission & Seat Matrix: The rules for admission & Seat matrix are as per university notification from time to time.

Admission to other semesters: students are allowed to take admissions to successive semesters under carry over benefit (COB) facility.

2.0 Attendance: Every student must have at least 75% attendance in each paper (Theory & Practical) in each semester. Shortage of attendance will be dealt with as per the university rules from time to time.

3.0 Medium of instruction: The medium of instruction shall be English.

4.0 Course Structure:

There shall be *Three* category of Papers namely, Core subject (Theory & Practicals), Soft core (50 marks spectroscopy paper), project dissertation and Open Elective (Theory) Papers for M.Sc. in Chemistry.

In the 1st semester, there shall be 4 core theory papers of 4 credits in each paper and 3 core subject practical papers of 2 credits each and 1 soft core paper of 2 credits.

In 2nd semester, there shall be 3 core theory papers of 4 credits in each paper and 3 core subject practicals of each 2 credits, 1 soft core paper of 2 credits and one Open Elective paper with 4 credits.

In 3rd semester, there shall be 3 core theory papers of 4 credits in each paper and 3 core subject practicals each of 2 credits, 1 soft core paper of 2 credits and one Open Elective paper with 4 credits.

In the 4th semester, there shall be 3 core theory papers of 4 credits in each paper and 3 core subjects of practicals each of 2 credits, 1 soft core paper of 2 credits & one **Project** with 4 credits.

Syllabus for Each paper of 4 Credits shall have four Units of 16 h each & Each paper of 2 Credits shall have two Units of 16 h each.

Project work of 4th semester shall be allocated during the 3rd semester itself so that it can be planned well in advance for effective execution under the supervision of Internal and/or External Guide. The Project team shall not exceed *Three* students for a given Topic of study.

5.0 Scheme of Evaluation:

There shall be an examination at the end of each Semester.

The duration of Examination of Theory paper carrying 80 marks is 3 h & duration of Examination of Theory paper carrying 40 marks is 2 h. Duration of Exam for Practicals (Lab) is 4 h and number of students per batch should not exceed 15.

The IA marks of Theory papers are based on average of two IA Tests per Paper per semester as well as Attendance, Seminar and Assignments (if any). The weightage of marks for these components may be distributed accordingly.

The IA marks of Practical paper are based on one IA Tests per Paper per semester.

At least one seminar per Year should be assigned for each student as per the convenience.

The Theory and Practical Examinations of all the semesters shall be evaluated through single / double valuation by an Internal / External examiner as per the guidelines of RCU.

Project: The project report shall be evaluated for 80 marks by one Internal and one External examiner based on the *Dissertation* & Oral presentation.

IA marks of 20 allocated for Project work must be earned from ***Industrial visit/ Technical / Study tour*** of minimum 2 days to be undertaken during the 2nd Yr M.Sc. course. Such a visit/ tour (within India) must be endorsed by the Chairman, Dept. of Chemistry (Principal of Affiliated College). The financial support (partial/full) to the enrolled students and Faculty members accompanying the team may be reimbursed by the University/ Affiliated College, as per the norms.

In case the student cannot undertake ***Industrial visit/ Technical / Study tour*** due to health issues or unavoidable circumstances, IA marks shall be based on the presentation of the work in a seminar.

6.0 Pattern of question paper: 80 (Exam) + 20 (IA)

Question paper contains five questions. Question 1 is compulsory. It shall contain 10 objective type questions carrying 2 marks each, drawn from all the four units. Questions 2, 3, 4 and 5 should be drawn from each Unit for 16 marks each (sub questions a, b and c or d carry 5, 5 and 6 marks).

7.0 Maximum period for the completion of M.Sc. Degree Progrmme: There shall be fully carry over system from First to Fourth semesters. Maximum number of years for a student to complete the degree is as specified by the University from time to time.

8.0 The General Regulations Governing Post Graduate Programmes under CBCS and Regulation Governing Post Graduate Programmes in the School of Basic Sciences under CBCS of Rani Channamma University, Belagavi are applicable to this course for all the matters not covered under this.

Course structure of M.Sc. degree in CHEMISTRY and ORGANIC CHEMISTRY @ BGKUJ

*T-Theory, P-Practical/Project

Subjects	Paper	Instruction hrs/ week	Duration of Exam, h	Marks			Credits
				IA	Exam	Total	
a) 1st Semester of the PG Program							
Core Subject	4 T	4 × 4 =16	4 × 3	4 × 20	4 × 80	4 × 100	4 × 4 = 16
	3 P	3 × 4 =12	3 ×4	3 × 10	3 × 40	3 × 50	3 × 2 = 6
Soft Core	1 T	1 × 2 =2	1 × 2	1 × 10	1 × 40	1 × 50	1 × 2 = 2
Per Semester Total of Credits							**24**
b) 2nd Semester							
Core Subject	3 T	3 × 4 =12	3 × 3	3 × 20	3 × 80	3 × 100	3 × 4 = 12
	3 P	3 × 4 =12	3 ×4	3 × 10	3 × 40	3 × 50	3 × 2 = 6
Soft Core	1 T	1 × 2 =2	1 × 2	1 × 10	1 × 40	1 × 50	1 × 2 = 2
OEC	1 T	1 × 4 =4	1 ×3	1 × 20	1 × 80	1 ×100	1 × 4 = 4
Semester Total of Credits							**24**
Program Grand Total of Credits							**48**

T - Theory, P- Practical/ **Pr**oject, OEC-Open Elective

* For earning IA marks of Project work, please refer to Section 5.4 in the regulation.

Course structure of M.Sc. degree in CHEMISTRY @ BGKUJ

COURSE CODE		Papers details	Course Type	Teaching/ week	Duration of Exam, h	Marks			Credits
						Exam	IA	Total	
		1st semester							
1	126MSC01CHEHCC01T	CHIT 1.1: Inorganic Chemistry-I	Hard Core	4	3	80	20	100	4
2	126MSC01CHEHCC02T	CHOT-1.2: Organic Chemistry-I	Hard Core	4	3	80	20	100	4
3	126MSC01CHEHCC03T	CHPT-1.3: Physical Chemistry-I	Hard Core	4	3	80	20	100	4
4	126MSC01CHEHCC04T	CHGT-1.4: Spectroscopy-I	Hard Core	2	2	40	10	50	2
5	126MSC01CHEHCC05T	CHES-1.5: Analytical Chemistry	Hard Core	4	3	80	20	100	4
6	126MSC01CHESCC01L	CHIPr -1.6: Inorganic Chemistry Practicals-I	Soft Core	4	4	40	10	50	2
7	126MSC01CHESCC02L	CHOPr-1.7: Organic Chemistry Practicals-I	Soft Core	4	4	40	10	50	2
8	126MSC01CHESCC03L	CHPPr -1.8: Physical Chemistry Practicals-I	Soft Core	4	4	40	10	50	2
		Total		30	28	480	120	**600**	**24**

COURSE CODE		Papers details	Course Type	Teaching/ week	Duration of Exam, h	Marks			Credits
						Exam	IA	Total	
		1Ind semester							
1	126MSC01CHEHCC06T	CHIT 2.1: Inorganic Chemistry-II	Hard Core	4	3	80	20	100	4
2	126MSC01CHEHCC07T	CHOT-2.2: Organic Chemistry-II	Hard Core	4	3	80	20	100	4
3	126MSC01CHEHCC08T	CHPT-2.3: Physical Chemistry-II	Hard Core	4	3	80	20	100	4
4	126MSC01CHEHCC09T	CHGT-2.4: Spectroscopy-II	Hard Core	2	2	40	10	50	2
5	126MSC01CHEOEC01T	CHES-2.5: Open Elective	OEC	4	3	80	20	100	4
6	126MSC01CHESCC04L	CHIPr -2.6: Inorganic Chemistry Practicals-II	Soft Core	4	4	40	10	50	2
7	126MSC01CHESCC05L	CHOPr-2.7: Organic Chemistry Practicals-II	Soft Core	4	4	40	10	50	2
8	126MSC01CHESCC06L	CHPPr -2.8: Physical Chemistry Practicals-II	Soft Core	4	4	40	10	50	2
		Total		30	28	480	120	**600**	**24**

BAGALKOT UNIVERSITY, JAMKHANDI

Syllabus of M.Sc. degree in CHEMISTRY

FIRST SEMESTER

Core Subject Code: 126MSC01CHECSC01T

Paper Title :CHIT-1.1 : INORGANIC CHEMISTRY-I

Teaching: 4 h/ week & Credits : 4 **Total: 64 h**

UNIT-I **16 h**

CHEMICAL BONDING

Ionic Bonding

Formation, conditions for the formation of ionic compounds, lattice energy, Born-Lande's equation, calculation of lattice energy from Born-Lande's equation (problems should be solved), conclusions from Born-Lande equation, Born-Haber cycle and its applications (problems should be solved), Kapustinskii equation, factors affecting the lattice energy, properties of ionic substances, Covalent character in predominantly ionic bonds, polarizing power, factors governing the degree of polarization, Fajan's rules in predicting the melting and boiling points and solubility of some compounds.

Energetics of solubility of ionic salts in polar solvents, solvation energy, relative effects of ionic radii on lattice energy and ion-solvation energy, relative solubility of ionic compounds (alkali metal halides and silver halides, sulphates and hydroxides of alkaline earth metals).

Covalent bonding:

Valence bond theory: hybridization of atomic orbitals, Examples for compound having different hybridization (*sp*, sp^2, sp^3, dsp^2, sp^3d, sp^3d^2).

VSEPR theory: Predicting molecular geometries, Bent's rule of hybridization, illustration of Bent's rule with respect to CH_3F, PCl_3F_2), limitations of VSEPR theory.

Molecular orbital theory: Symmetry and overlap, molecular orbital diagrams of diatomic homo nuclear molecules/ions (up to second period elements), hetero-nuclear molecules/ions (HCl, LiF, CO, NO, NO^+ and triatomic molecules–linear (CO_2) and angular (NO_2). Magnetic properties of the molecules/ions based on the MOT, stability of molecules or ions based on bond order. Walsh diagrams for XH_2 species.

Metallic bonding: Characteristics of metallic states, electron sea model, V. B. approach, band theory (MOT).

Self study: Review of different types of chemical bonds with suitable examples. Skill component: Determine the bond energy and calculate the lattice energies and discuss their application.

UNIT-II **16 h**

CHEMISTRY OF NON-TRANSITION ELEMENTS-I

Electron deficient compounds: Classification of boranes, nomenclature of boranes.**:** Synthesis, structure and properties **of** B_2H_6, B_3H_9, B_4H_{10}, B_5H_9, B_5H_{11} and B_6H_{10}. Polyhedral skeletal electron pair counting using Wade's rules (*styx* numbers): classification of boron clusters using electron pair count.

Carboranes: Classification, Nomenclature, Synthesis of closocarboranes ($C_2B_{10}H_{12}$). Structural aspect of closo-$C_2B_{10}H_{12}$.

Metalloborane: Synthesis and structural aspects of $[B_{11}H_{11}AlCH_3]^{2-}$, $[Fe(CO)_3B_4H_8]$ and [2-$CpCoB_4H_8$].

Metallocarboranes: Synthesis of $[(C_2B_9H_{11})_2Fe]^{2-}$, $[C_2B_9H_{11}FeCp]^-$ and $[Co(C_2B_9H_{11})_2]^-$, Structure and Bonding in $[Co(C_2B_9H_{11})_2]^-$

Borazines: Synthesis, reactivity and, structure and bonding.

Electron Rich Compounds: Compounds of Noble gases, Preparation and structure and bonding in Xenon compounds (XeF_2, XeF_4, XeF_6, $XeOF_4$, XeO_2F_2, XeO_3, XeO_4) based on VBT and VSEPR.

Self study: Electron deficient compound other than Boran and Lewis acids.
Skill component: Demonstration on the handling of redox sensitive and air/moisture sensitive materials.

UNIT-III **16 h**

COORDINATION CHEMISTRY AND METAL CLUSTERS

Coordination chemistry: Coordination numbers (1 to 7) and their geometries, geometrical isomerism in square planar and octahedral complexes, optical isomerism in octahedral complexes.

Bonding theories: Review of VBT, EAN and their limitations, Spectrochemical series (Irwin-William series), Crystal Field Theory, splitting of d-orbitals in octahedral, tetrahedral, square planar, trigonal bipyramidal and square pyramid geometries, Jahn-Teller distortion in co-ordination compounds. Factors affecting the CFSE values. Limitations of CFT, evidences for metal ligand orbital overlap, Molecular Orbital Theory with sigma (σ) bonding applied to octahedral, tetrahedral and square plannar complexes. MO-Theory with π(pi)–bonding applied to octahedral complexes.

Metal Clusters

Dinuclear compounds: Quadrapole bonding, calculation of M-M bond order and structural aspects and magnetic properties of $Re_2Cl_8^{2-}$.

Trinuclear clusters: Bond order, magnetic properties and structural aspects of Re_3Cl_9.

Self study: Basics of Coordination Chemistry (Review of VBT, EAN and their limitations).
Skill component: Methods to Identify cis- & trans- as well as L- & D-isomerism.

UNIT-IV **16 h**

Pi (π) ACID METAL COMPLEXES AND ACID-BASE CHEMISTRY

Metal Carbonyls: Different binding modes of CO, pi (π) acidity of CO, back bonding, synergic effect, mononuclear carbonyls, low nuclearity carbonyl clusters and high nuclearity carbonyl clusters, application of 18 electron rule to metal carbonyls.
Structural features of $[Co_2(CO)_8]$, $[Co_4(CO)_{12}]$ and $[Fe_3(CO)_{12}]$.
Preparation and structural aspects of $Ni(CO)_4$, $Fe(CO)_5$ and $Co_2(CO)_8$ by direct reaction of metals, $V(CO)_6$, and $Mn_2(CO)_{10}$ by reductive carbonylation.
Metal Nitrosyls: Coordinating behavior of NO, NO as a bridging ligand, factors favoring linear and bent M-N-O linkage, synthesis of nirosyl complexes (brown ring complex).
Dinitrogen Complexes: Reason for poor coordinating behavior of N_2 compared to its isoelectronic species, binding modes of N_2, preparation of Ru and Mo dinitrogen complexes.
Acid-Base Chemistry: Bronsted-Lowry concept, Lux-Flood theory, solvent-system definition, Lewis theory, Usanovich concept, Hammett acidity function (superacids), HSAB theory.
Self study: structural features of $Ni(CO)_4$, $Fe(CO)_5$ and $Co_2(CO)_8$
Skill component: Preparation of one metal nitogen compound and its characterization.

REFERENCE BOOKS:

01. Inorganic Chemistry: Principles, structure and reactivity, 1997, J. E. Huheey, Keiter and Keiter.
02. Inorganic Chemistry, 3rd edition, C. E. Housecroft and A. G. Sharpe.
03. Inorganic Chemistry by Purcel and Kotz.
04. Inorganic Chemistry by J. D. Lee.
05. Inorganic Chemistry by W. W. Porterfield.
06. Concepts and Models of Inorganic chemistry by Douglass, Alexander and Mcdaniel.
07. Advanced Inorganic Chemistry by Cotton and Wilkinson.
08. Inorganic Chemistry by Miessler and Tarr.
09. Fundamental concepts of Inorganic Chemistry by A. K. Das, volume 1 to 7.
10. Chemistry of Elements by N N Greenwood and A. Earnshaw (2nd Ed) 1997

FIRST SEMESTER

Paper Title : CHIPr -1.6 **INORGANIC CHEMISTRY**

Core Subject Code: 126MSC01CHESCC01L

PRACTICALS-I

Duration: 4 h/ week & Total: 64 h **Credits : 2**

Part A. Ore Analysis:

01. Haematite: Iron by volumetric (potassium dichromate and Ceric ammonium sulphate) method and by colorimetric method
02. Pyrolusite: Determination of manganese dioxide in pyrolusite using permanganate titration
03. Estimation of calcium and magnesium carbonates in dolomite using EDTA titration, and gravimetric analysis of insoluble residue.

Part B. Alloy Analysis :

04. Quantitative analysis of Copper-Nickel in alloy /mixture:
05. Copper volumetrically using KIO_3.
06. Nickel gravimetrically using DMG
07. Quantitative analysis of Copper-Zinc in alloy/mixture:
    i. Copper gravimetrically as Cu(I) thiocyanate.
    ii. Zinc by volumetrically by EDTA method

Part C. Determination of COD and BOD of polluted water.

REFERENCE Books:

1. Vogel's Textbook of Quantitative chemical analysis, - J Mendham, R.C. Denney, J.D. Barnes M.J.K. Thomas, peason education, india. 3rd, 4th , 5th and 6th edition.2008
2. Vogel's Quantitative Inorganic analysis , 7th edition G. Svehla , B.Sivasankar, pearson education, India.
3. Practical Inorganic Chemistry, - K. Somashekara Rao, Chennupati Venkata Suresh.BPS books,2019.
4. Principles of Inorganic Chemistry,- Puri, Sharma, Khalia.Mlestone publishers & distributors, 2014.

FIRST SEMESTER

Core Subject Code: 126MSC01CHEHCC02T

Paper Title : CHOT-1.2 : ORGANIC CHEMISTRY-I

Teaching: 4 h/ week & Credits : 4 **Total: 64 h**

UNIT-I **16 h**

BASIC CONCEPTS AND REACTION MECHANISM

Concept of hybridization: sp^3, sp^2, sp – with examples.

Electronic effects: Inductive, electronic, resonance and hyperconjugation.

Classification of organic reagents and reactions.

Reactive Intermediates: carbocations, carbanions, free radicals, carbenes, nitrenes, and arynes- their formation, stability, structure and reactions.

Organic acid and bases: Effect of substituents with examples

Reaction Mechanism: Classification, determination of reaction mechanism by kinetic and non-kinetic-methods.

Kinetic Method: Mechanistic implications from rate laws, the transition state theory, ambiguities ininterpreting kinetic data, solvent effect, ionic effect, isotopic effect, solvent isotopic effect, substituent effect, steric effect, linear free energy relationships– Hammett equation and Taft treatment.

Non-kinetic methods: Energy profile diagram, identification of products, testing possible intermediates, trapping of intermediates, cross over experiments, isotopic labeling, stereochemical studies, limitations.

Self study (SS): Basic of atom, molecules, hybridization, ionization energy, electron affinity, electronegativity, delocalization, Bohr theory, Aufbau principle, steric effect, rate of reaction, activation energy, isotopes, stereochemistry.

Skill components: Free radical- ESR spectra of some of the molecule analysed. Carbocation- isolated compound list and analysis.

UNIT-II **16 h**

ADDITION AND ELIMINATION REACTIONS

Addition reactions: Types of addition reactions, mechanism and stereochemistry of addition, effect of substrates and solvents during addition. Addition to Carbon-Carbon double bond-addition of hydrogen halide(Markonikov's rule), bromine. Addition to carbon-hetero multiple bonds (C=O)-Introduction, structure and reactivity, HCN, bisulphate, Grignard reagent, hydride, amino compounds, alcohols and thiols.

Elimination reactions: Introduction, types of elimination-E_1, E_2, E_{1CB} mechanisms, orientation during elimination reactions-Saytzeff and Hoffmann rules, pyrolytic eliminations, Chugave, Cope eliminations, Hoffmann degradation and dehalogenation of vicinal di halides, substitution v/s elimination with suitable example.

Self study (SS): Basics of saturated and unsaturated compounds, Markonikov's and anti-Markovnikov's rule, electrophiles and nucleophiles,

geminal and vicinal compounds, difference between addition and elimination reactions.

Skill components: Analyse some addition and elimination product by FT-IR , UV-vis and NMR spectra available from open access/recorded.

UNIT-III **16 h**

SUBSTITUTION REACTIONS

Aromatic electrophilic substitution reactions: General mechanism of electrophilic substitution in aromatic systems using examples of nitration, halogenations, sulphonation and Friedal Craft alkylation and acylation.

Orientation effect of disubstitution in aromatic systems with suitable examples.

Nucleophilic substitution at saturated carbon: Mechanism of S_N1, S_N2, $S_Ni$reactions– effect of solvent, substrate and leaving group, neighboring group participation, substitution at vinylic and allylic carbon.

Aromatic nucleophilic substitution reactions: Substitution of hydrogen, substitution other than hydrogen, S_NA_r reactions, S_N1, S_N2 and benzyne mechanism, Bucherer reaction.

Self study(SC): Basics of Aromaticity, electrophiles and nucleophiles, electron withdrawing and electron releasing groups and their examples, difference between solute and solvents, vinylic and allylic groups, acids and bases, saturated and unsaturated carbons, stereochemistry (retension & inversion), rate of reaction and activation energy.

Skill components(SC): SN^1, & SN^2 products may be analyzed by polarimeter method and record and analyzed nitration and halogenation products using UV-Vis and FT-IR.

UNIT-IV **16 h**

STEREOCHEMISTRY

Optical isomerism: Concepts of chirality-symmetry elements and cause for optical activity, chiral structures, relative configuration- Fischer's DL notation, threo and erythro nomenclature , absolute configurations- R, S nomenclature.

Molecular presentation: Sawhorse, Newman, Fischer and fly wedge formulae, enantiomers, epimers, anomers, recemic mixtures, resolution of racemic mixtures- Mechanical, biochemical and chemical method.

New methods of asymmetric synthesis: using optically active reagents, optically active substrates and optically active catalysts with suitable examples.

Enantio selective synthesis and diastereo selective synthesis.

Conformational analysis: Simple acyclic systems (butane, 1,2-dichloroethane) and cyclic systems(chair and boat forms of cyclohexane), effect of conformation on reactivity in acyclic and cyclic systems with suitable examples, stereoisomerism in biphenyls, allenes, and spirans.

Geometrical isomerism: Cis-trans, E-Z and syn-anti notations for geometrical isomers, geometrical isomerism in substituted alkenes, oximes, monocyclic and

fused and bridge ring system, determination of configuration of geometrical isomers-physical and chemical methods.

Self study(SS):Basics of stereochemistry, classification, Isomerism, optical activity, chiral compounds, priority order, cis-trans, dextro-levo, oxidizing and reducing agents, plane of polarization.
Skill components(SC): Students need to create suitable model for R & S configuration by stick & ball method. Dextro & leavo rotation of some samples record/analyzed by suitable data.

REFERENCE BOOKS:

01. Understanding organic reaction mechanisms, A. Jacob, Cambridge Univ. Press, 1997.
02. Introduction to organic chemistry A. Streitweiser, Jr and C. H. Heathcock, Macmillan, 1985.
03. Physical and mechanistic organic chemistry, R.A.Y. Jones, 1st Edn. Cambridge Univ. Press, 1979.
04. Mechanisms of molecular migrations, Vols I and II, B. S. Thiagarajan, 1st Edn. Pergamon Press, Oxford, 1979.
05. P. J. Garratt in Comprehensive organic chemistry, D. Barton and W. D. Ollis, 1st Edn. Pergamon Press, Oxford, 1979.
06. Radicals in organic synthesis, B. Giese, Pergamon Press, 1986.
07. Stereoelectronic effects in organic chemistry, P. Deslongchamps, 1st Edn. Pergamon Press, 1983.
08. Organic photochemistry, J. M. Coxon and B. Halton, 1st Edn, Cambridge Univ. Press, London, 1974.
09. Molecular reactions and photochemistry, C. H. Deputy and D. S. Chapman, 1st Edn. Prentice-hall India, New Delhi, 1972.
10. Stereochemistry of carbon compounds, E. L. Eliel, S. H. Wilen and L. N. Mander, John Wiley & Sons, 1994.
11. Stereochemistry, Potapov, MIR, Moscow, 1984.
12. Stereochemistry, Nasipuri, D, New Age, 1999.
13. Advanced organic chemistry, J. March, 4th Edn. John Wiley, 2008.
14. Organic Chemistry, R. E. Ireland Prentice-Hall India, New Delhi, 1975.
15. Some modern methods of Organic Synthesis, W. Caruthers, Cambridge Uni. Press London, 2nd Edn. 1998.
16. Stereochemistry of organic compounds- Principle and applications, D. Nasipuri, 2nd Edn., New Age International Publishers, 2001.

FIRST SEMESTER

Core Subject Code: 126MSC01CHESCC02L

Paper Title : CHOPr-1.7: ORGANIC CHEMISTRYPRACTICAL-I

Duration: 4 h/ week & Total: 64 h **Credits : 2**

TWO STEP PREPARATIONS

01. Preparation of acetanilide from aniline
02. Preparation of p-bromoacetanilide from acetanilide
03. Preparation of hydrolysis of p-bromoacetanilide to p-bromoaniline
04. Preparation of p-nitroacetanilide from acetanilide
05. Preparation of hydrolysis of p-nitroacetanilide to p-nitroaniline
06. Preparation of bezoic acid from benzaldehyde
07. Preparation of 2-hydroxynaphthaldehye from 2-naphthol
08. Preparation of 2,4,6 tribromo benzene from aniline
09. Preparation of phenylazo-β-naphthol
10. Preparation of 1-phenyl-3-methyl-pyrazolone

NOTE : Two preparations are to be given for Practical Examinations.

REFERENCE BOOKS:

01. Vogel's Text Book of Practical Organic Chemistry, Furniss, Hannaford, Smith and Tatchell, ELBS Longmann
02. Advanced Practical Organic Chemistry, N.K. Vishnoi, Vikas, Publishing House
03. Handbook of Practical Organic Chemistry, Clark
04. Practical Organic Chemistry, O.P. Agrawal

FIRST SEMESTER

Core Subject Code: 126MSC01CHEHCC03T

Paper Title : CHPT-1.3 : PHYSICAL CHEMISTRY-I

Teaching: 4 h/ week & Credits : 4 **Total: 64 h**

UNIT-I **16 h**

QUANTUM CHEMISTRY-I

A brief resume and comparative studies of classical and quantum mechanical phenomenon, Summarization of the results of some experiments (black body radiation, Plank quantum theory, term symbols), Photoelectric and Compton effects. Davison and Germer experiment, Franck-Hertz experiment, Young's double slit experiment. Derivation of Bohr's principle of quantization of angular momentum of electron from de-Broglie's relationship, consequences of de-Broglie equation, de-Broglie concept (To be derived). Uncertainty principle, mathematical expression for uncertainty principle. Postulates of quantum mechanics, operators, algebra of operators, ψ properties. Hamiltonian operators and their properties, Schrödinger's equation (with respect to space and time time). Physical significance of and characteristics of wave function, eigen function and eigen values, probability distribution function, normalization of ψ, orthogonality of ψ boundary valued condition. Application of equation to one dimension box.

Skill development: Installation and operating DFT Software.

UNIT-II **16 h**

THERMODYNAMICS-I

Review of basic principles of thermodynamics (I and II laws of thermodynamics, concept of free energy and entropy, combined form of first and second laws of thermodynamics. Entropy change during spontaneous process. Helmholtz and Gibbs free energies. Thermodynamic criteria of equilibrium and spontaneity. Variation of free energy with temperature and pressure. Third law of thermodynamics-calculation of absolute entropies. Real gases and fugacity, Variation of fugacity with temperature and pressure. Thermodynamics of dilute solutions: Raoult's law, Henry's law. Ideal and non-ideal solutions: Liquid-liquid solutions, liquid-solid solutions, multicomponent systems and excess thermodynamic properties.Maxwell's relation (to be derived). Thermodynamic equations of equipartition of energy, Classius-Clapeyron equation (to be derived) and its application. Entropy of vaporization. Vant-Hoff's equation, integrated form of van't Hoff's equation. (problems to be solved).

Skill development: Temperature dependent chemical reactions

UNIT-III **16 h**

ELECTROCHEMISTRY -I

Arrhenius theory of strong and weak electrolytes and its limitations, theory of ionic conductance in solutions, ionic atmosphere, relaxation and electrophoretic effects, Debye-Huckel theory of strong electrolytes, Debey-Huckel-Onsagar equation(derivation) and Debey-Huckel limiting law(derivation), quantitative and qualitative treatment of Debye-Huckel limiting law, Onsagar activity co-efficient, mean ionic strength (Debey-Huckel limiting law). A brief survey of Helmholtz-

Perrin, Gouy-Chapman and Stern electrical double layer (No Derivation). Liquid junction potential and its determination. Fundamentals of batteries, classification of batteries, battery characteristics, primary batteries, dry cell, alkaline MnO_2 batteries and other batteries, secondary batteries-lead acid, alkaline storage batteries and fuel cells types and applications.

Skill development: Cyclic Voltammetric Study of ferrocyanide/ferricyanide Redox couple

UNIT-IV **16 h**

POLYMER AND DENDRIMER CHEMISTRY: Basic concepts: Monomers, polymers and degree of polymerization, general classification of polymers, homopolymers, copolymers, terpolymers. Polymer molecular weight: Number average and weight average molecular weights, polydispersity and molecular weight distribution in polymers. Viscoelastic behavior of polymers (Stress Strain curve). Addition polymers and condensation polymers, comparison between thermoplastics and thermosetting polymers. Transition in Polymers: Definition of glass transition temperature (Tg) and flow temperature (Tf) and melting temperature (Tm). Thermal behavior of amorphous and crystalline polymers, factors affecting Tg. Plasticizers, properties and their effect on Tg of PVC. Comparison of Tg and Tm, Tg of copolymers and polymer blends, relation between Tg and Tm. Preparation, properties and commercial importance: polyethylene, polystyrene, polyvinyl chloride, poly sulphone, polyurethances, polyisoprenes. Metallocene catalysis polymerization (Ziegler-Natta polymerization). Methods of polymer fabrications, Fabrication of shaped polymer objects, Spinning industrial polymers. **Dendrimers and hyper-branched polymers:** Introduction to dendrimers, methods of preparation, common properties and applications. Synthesis of polyamidoamines using devergent route and dendratic polyether macromolecules using convergent route.

Skill development: Visiting polymer industriesaround Belgaum

REFERENCE BOOKS:

01. Physical chemistry –Moore,Orient Longman,1972.
02. Principle of polymer science, by Bhahadur and N.V Shastry, 2nd addition Nonasa, 2011
03. An introduction to Chemical Thermodynamics –R. P.Rastogi and S.S.Misra, Vikash, Delhi, 1978.
04. Thermodynamics –Rajaram and Kunakose,East West, Nagin Cx,Dehli,1986.
05. An introduction to Electrochemistry –Glastone,East west Ltd.
06. Electrochemistry principles and applications –Porter
07. Introduction to electrochemistry by S. Glasstone.
08. Modern electrochemistry Vol. I and II, by J.O.M. Bockris and A.K.N. Reddy, Pentium Press, New York (1970).
09. Electrochemistry –Principles and applications by E.G. Potter.
10. Electrochemistry by Reiger, Prentice Hall (1987).
11. Industrial Electrochemistry–D. Pletcher and F.C. Walsh, Chapman, II Edition, 1984

12. Introductory Quantum Mechanics – Atkins ,Claredon,Oxford
13. Quantum chemistry-Kauzman,Academic Press,1957.
14. Quantum chemistry-R.K.Prasad ,II.Ed,New Age Int-2000
15. Textbook of polymer science –Billmeyer, Willey Intersection.
16. Polymer Science- V. R. Gowariker, 2010.

FIRST SEMESTER

Core Subject Code: 126MSC01CHESCC03L

Paper Title : CHPPr-1.8 PHYSICAL CHEMISTRY PRACTICALS-I

Duration: 4 h/ week & Total: 64 h **Credits : 2**

1. **Conductometry**

a. Acid mixture versus NaOH

b. Weak acid with salt versus NaOH

c. Strong acid with salt versus NaOH

d. To determine the acidic and basic dissociation constant of an amino acid and determination of isoelectric point by pH metry.

e. Determine the equivalent conductance at infinite dilution for acetic acid by applying Kohlrausch's law of independent migration of ions.

2. **Potentiometry**

1. $K_2Cr_2O_7$ versus FAS
2. Acid mixture versus NaOH
3. $KMnO_4$ versus FAS
4. Determination of dissociation constant of H_3PO_4 using potentiometric method.
5. Determination of pKa value of phosphoric acid by pH meter.

REFERENCE BOOKS:

1. Advanced Physico-Chemical Experiments –J. Rose.
2. Practical Physical Chemistry –S.R. Palit.
3. Experiments in Physical Chemistry – Yadav, Geol Publishing House.
4. Experiments in Physical Chemistry – Palmer.
5. Experiments in Chemistry –D.V. Jahagirdar, Himalaya Publishing House, Bombay, (1994).
6. Experimental Physical Chemistry –Das. R.C. and Behera B, Tata Mc Graw Hill

FIRST SEMESTER

Soft Core Code: 126MSC01CHEHCC04T

Paper Title : CHGT-1.4 SPECTROSCOPY-I

Teaching: 2 h/ week & Credits : 2 **Total: 32 h**

UNIT-I **16 h**

MICROWAVE and RAMAN SPECTROSCOPY

Electromagnetic radiation: Interaction of radiation with matter-absorption, emission, reflection, refraction, transmission, dispersion, polarization, interference and scattering, natural line width and broadening (Doppler effect), Heisenberg uncertainity and intensity of spectral lines, regions of electromagnetic spectrum and their corresponding energies: rotational, vibrational and electronic transitions and their energy levels.

Microwave spectroscopy: Diatomic molecules**-r**igid and non rigid rotatormodel(No derivation), rotational quantum number and the selection rule, effect of isotopic substitution on rotation spectra, relative intensities of the spectral lines, classification of polyatomic molecules based on moment of inertia-linear, symmetric top, asymmetric top and spherical molecules, rotation spectra of polyatomic molecules(CO_2, CH_3F and BCl_3), moment of inertia expression for linear tri-atomic molecules, experimental techniques-microwave spectrometer, applications-principles of determination of bond length and moment of inertia from rotational spectra and determination of dipole moments.

Raman spectroscopy: Introduction, Raman and Rayleigh scattering, Stokes and anti-Stokeslines, polarization of Raman lines, depolarization factor, polarizability ellipsoid, theories of Raman spectra-classical and quantum theory, comparison of Raman and IR spectra, rule of mutual exclusion principle, advantages of Raman spectra.

Self study(SS): Basic of emission, reflection, refraction, transmission, dispersion, polarization, scattering, Doppler effect, Heisenberg uncertainity,diatomic molecules**,** isotopes, polyatomic molecules, moment of inertia, tri-atomic molecules, bond length anddipole moments. Basic of Raman Theory, polarisability

Skill component (SC): Raman spectral studies of any two compounds.

UNIT-II **16 h**

UV-VISIBLE and INFRARED SPECTROSCOPY

UV-visible spectroscopy: Types of transitions and their theoretical interpretation, Beer's law, Lambert's law, Beer's-Lambert's law, limitations, chromophores, auxochromes, effect of substituents on the position of λmax, prediction of λmax for polyenes, α,β-unsaturated aldehydes and ketones (Woodward- Fisher rules), aromatic systems and their derivatives. basic components of instrumentation-single and double beam designs, applications-analysis of binary mixtures, measurement of dissociation constants of acids and bases.

IR spectroscopy: Vibration of diatomic molecules, vibrational energy curves for simple harmonic oscillator, effects of anharmonic oscillation, vibration-rotation spectra of carbon monoxide(No derivation), expressions for fundamental and overtone frequencies, vibrations of polyatomic molecules–The number of degrees of freedom of vibration, , modes of vibration(CO_2 and H_2O), fundamental, overtone,

combination, hot bands, Fermi resonance, force constant and its significance, theoretical group frequency, intensity of absorption band and types of absorptions, identification of functional groups- alkanes, alkenes, aromatics, carboxylic acids, carbonyl compounds(aldehydes and ketones, esters), amides and amines, fingerprint region, vibrational coupling, hydrogen bonding, steric effect and ring strain.

Self study(SS): Basic of IR spectroscopy, Quantum theory of IR, Polarity of bond,.
Skill component (SC): Selected organic compounds may record UV-vis absorption of benzophenone, benzaldehyde and substituted compounds. And student needsto study, how to calculate molar extinction co-efficient (ε), λ_{max} and concentration of some of the molecules/proteins.
Selected six organic compounds may record FT-IR and analysed complete spectrum of stretching and bending.

REFERENCE BOOKS:

01. Fundamentals of Molecular Spectroscopy, C. N. Banwell and E. M. McCash. 4th edition, Tata McGraw-Hill, New Delhi.
02. Introduction to Molecular Spectroscopy, G. M. Barrow, McGraw-Hill, New York.
03. Introduction to Spectroscopy. Pavia, Lampman and Kriz, 3rd edition, Thomson.
04. Spectroscopy, B. P. Straughan and S. Walker, John Wiley & Sons Inc., New York, Vol. 1 & 2, 1976.
05. Vibration Spectroscopy Theory and Applications, D. N. Satyanarayana, New age International, New Delhi.
06. Organic Spectroscopy, William Kemp, 3rd edition, Palgrava, 1991.
07. Optical Method of Analysis, E. D. Olsen, McGraw Hill Inc, 1975.
08. Spectroscopy of organic compounds – P. S. Kalasi, Wiley Eastern Ltd, India 1993.
09. Introduction to instrumental analysis – R. D. Braun, McGraw Hill Book company 1982.
10. Physical methods in inorganic chemistry – R. Drago, East West Pvt. Ltd, 1968.
11. Instrumental methods of chemical analysis – Gurdeep Chatwal and Anand.
12. Organic Spectroscopy, 2nd edition– Jag Mohan, Narosa Publishing House New Delhi.
13. Applications of IR and Raman spectroscopy to coordination and organometallic compounds, K. Nakamoto.

FIRST SEMESTER

Core Subject Code: 126MSC01CHEHCC05T

Paper Title : CHES-1.5: ANALYTICAL CHEMISTRY

Teaching: 4 h/ week & Credits : 4 **Total: 64 h**

UNIT-I **16 h**

DATA ANALYSIS

Classification of analytical methods: Types of instrumental analysis, analytical methods on the basis of simple size. Errors, types of errors, determinate and indeterminate errors, accuracy and precision. Distribution of random errors, frequency distributions normal error curves. Statistical treatment of finet samples, measure central tendency -mean, medium, range, average deviation, relative average deviation, standard deviation and variance. Students' confidence interval of the mean. Testing for significance, comparison of two means and two standard deviations. Criteria for rejection of an observation-Q test, control chart, propagation of errors, significant figures. Least square methods of deriving calibration of plots. Principles of sampling the sampling step. Methods for sampling solid, liquid and gaseous samples. Effect of sampling uncertainties. Sampling hazards, need for quality assurance: ISO 9000 series of quality of system.

UNIT-II **16 h**

CHROMATOGRAPHY

Introduction, Principles, classifications, fundamentals of chromatography (Partition coefficient, Retardation factor, retention volumes), Dynamics of chromatography (Efficiency, zone spreading, eddy diffusion) chromatograms, retention time and column efficiency, plate theory and rate theory, Van-Deemeters equation, column resolution, factors influencing resolution.

THIN LAYER CHROMATOGRAPHY

Introduction, stationary and mobile phase systems, Rf value calculation, various technique of developments, visualization and applications.

ION EXCHANGE CHROMATOGRAPHY

Introduction, principle, classification of ion exchange resins, mechanism of ion exchange, synthesis of ion exchange resins (cation and anion), characteristics of ion exchange resins (size, capacity, cross linking and swelling and resistance) applications in analytical and metal separations.

HIGH PERFORMANCE LIQUID CHROMATOGRAPHY

Introduction, principles, instrumentation, mobile phase, stationary phase, types of column, various detectors used, and applications.

UNIT-III **16 h**

SEPERATION TECHNIQUES and THERMAL METHODS OF ANALYSIS

Solvent Extraction: Definition, types, principle and efficiency of extraction, sequence of extraction process, factors affecting extraction-pH, oxidation state, modifiers, synergistic, masking and salting out agents, techniques-batch and continuous extraction, applications, Separation of lanthanides.

Electrophoresis: Introduction, types and techniques of electrophoresis, factor affecting migration of ions, continuous electrophoresis, thin layer electrophoresis,

moving boundary electrophoresis, zone electrophoresis, and Curtain electrophoresis, reverse osmosis electro dialysis, capillary electrophoresis and applications.

Thermal Methods of Analysis: Introduction, thermogravimetric analysis (TGA), types of thermogravimetric analysis, principle and method, automatic thermogravimetric analysis, instrumentation, types of recording thermobalances, sample holders, factors influencing thermograms and applications, isothermal analysis, Differential Thermal Analysis (DTA), principle of working, theory and instrumentation, simultaneous DTA-TGA curves, factors affecting results and applications. Differential Scanning Colorimetry(DSC), principle of working, theory, instrumentation and applications. Types of titrations and gravimetric analysis.

UNIT-IV **16 h**

ELECTROANALYTICAL TECHNIQUES

Introduction, electrochemical cells, faradic and non-faradic current, mass transfer in cells, galvanic and electrolytic cells, anodes and cathodes, liquid junction potential, schematic representation of cells.

Polarography: Theory, principle and applications classical polarography, dropping mercury electrode, polarogram, polarographic measurements, polarographic current, Ilkovic equation, current and concentration relationship, half wave potential, oxygen interference- advantages and limitations. Qualitative and quantitative analysis. Derivative polarography.

Amperometry and Coulometry at controlled potential and at constant current.

Cyclic voltametry - basic principles, instrumentation and applications, stripping voltammetry and its applications including Electro -organic synthesis.

Electrogravimetry - theory, electrode reactions, over-voltage, characteristics of a good deposit, completeness of deposition, Determination of copper and nickel in Cu-Ni alloy.

REFERENCE BOOKS:

01. Principle of Quantitative Chemical Analysis – Robert de levie, International edition (1997) McGraw Hill Co.
02. Quantitative Analysis- Day and Underwood, Prinitce Hall Indian, Pvt Ltd 6thedition (1993).
03. Vogel's Textbook of quantitative chemical analysis- Revised by G.H.jaffery, J. Bassett, J. Mendhm and R.C. Denney ELBS 5thedition (1998).
04. Quantitative Chemical Analysis: D.C Harris W.M. Freeman and Co, NY, USA, Ed, (1995).
05. Introduction to Instrumental Analysis – R.D Brun, McGraw Hill Book company (1982).
06. Physical Methods in Inorganic Chemistry- R. Drago, Affiliated to East west Pvt, (1968).
07. Introduction to chromatography- theory and practice-V.K. Srivastava and K.K.Srivastava, S. chand Company Ltd., IV Ed (1991).

08. Basic Concepts of analytical Chemistry- S.M Khopkar, New Age Intentional Publishers, IIEd.,(1998).
09. Analytical chromatography- G.R Chatwal, Himalaya Publishing House, VII Ed., (1998).
10. Principle Instrumental Analysis- Skoog, Hollar and Nieman, , Harcourt, Asia pvt Ltd., Indian New Delhi, VEd, (1998).
11. Fundamentals of Analytical Chemistry- Skoog, West and Hollar, Harcourt, Asia pvt Ltd., Indian New Delhi, VEd, (1998).

II SEMESTER

SECOND SEMESTER

Core Subject Code: 126MSC01CHEHCC06T

Paper Title : CHIT-2.1: INORGANIC CHEMISTRY-II

Teaching: 4 h/ week & Credits : 4 **Total: 64 h**

UNIT-I **16 h**

SYMMETRY AND GROUP THEORY

Molecular symmetry: Symmetry elements and symmetry operations, rotation axis, rules for orientation of molecules, plane of symmetry, rotation-reflection axis, centre of symmetry and identity element of symmetry, products of symmetry operations, general relations among symmetry elements and symmetry operations.

Group theory: Concept of a group, definition of a point group, procedure for classification of molecules into point groups, subgroups, Schoenflies and Hermann-Maugin symbols for point groups, multiplication tables for the symmetry operations of simple molecules, matrix notation for the symmetry elements and for geometric transformations, class of a group and similarity transformation.

Representation of groups: Reducible and irreducible representations, Great Orthogonality theorem and its consequences, labeling of irreducible representations, group theory and hybrid orbitals to form bonds, character tables (Cs, Ci, C2, C2v and C3v).

Applications of group theory: Applications of group theory to crystal field theory, bonding in octahedral and tetrahedral complexes, symmetry and dipole moments, symmetry and optical activity.

Self study: Finding the symmetry elements in compounds with higher CN (> 6)

Skill component: Construct the ball and stick model of any chairal compound and deduce the representations.

UNIT-II **16 h**

COORDINATION CHEMISTRY-REACTIONS, KINETICS AND MECHANISMS

Types of mechanisms in substitution reactions-dissociation, interchange and association.

Metal-ligand equilibria step-wise and overall stability/formation constant, factors affecting stability of metal complexes. Determination of stability constant by spectrophotometric (Job's) method.

Reactions and kinetics of substitution in square planar complexes: Trans effect, substitution reactions. Rate law and mechanism of nucleophilic substitution in square planar complexes, thermodynamic and kinetic stability.

Reactions and kinetics of substitution in octahedral complexes: Ligand field effects and reaction rates, mechanism of substitution in octahedral complexes, reaction rates influenced by acid and base, mechanism of redox reactions-outer sphere and inner sphere mechanisms. Marcus theory, photochemistry of metal complexes-types of photochemical reactions, photo-substitution and photo-redox reactions and excited

state outer sphere electron transfer reactions (solar energy conversion), complimentary and non-complimentary reactions.

Self study: Fundamental of Solar cell and its reaction mechanism.
Skill component: Find the rate law of substitution reaction using UV-Vis spectrophotometer.

UNIT-III **16 h**

SOLID STATE AND STRUCTURAL CHEMISTRY

Types of solids, close packing of identical solid spheres, tetrahedral and octahedral voids, packing fraction, radius ratio.

Crystallographic systems: Bravias lattices, Miller indices, external features of crystals.

Structures of selected crystals: normal and inverse spinels, hexagonal structures, pervoskites.

Defects in solids: Point defects (stoichiometric and non-stoichiometric), line defects and plane defects, stacking faults and grain boundaries.

Structural transformation of solids

Solid solutions : Hume – Rothery rules, substitutional solid solutions and interstitial solid solutions, solid solution mechanism.

Alloy systems: Phase diagram and their features with respect to alloys - two and three component systems, copper–zinc system, steels with reference to iron-carbon systems.

Self study: X-ray diffraction technique for powder sample and single crystal.
Skill component: Indexing of XRD pattern of a cubic system.

UNIT-IV **16 h**

NUCLEAR CHEMISTRY

Radioactivity, nuclear reactions, nuclear power reactors–radioactivity, determination of half life, radioactive decay kinetics, parent-daughter decay-growth relationships, secular and transient equilibria, nuclear reactions, spallation, nuclear fission and fusion, types of nuclear power reactors, basic features and components of a nuclear power reactor, safety measures, an introduction to breeder reactors, applications of radioisotopes-synthesis of various useful radioisotopes, physico-chemical and analytical applications-isotope dilution method, activation analysis, radiometric titration and ^{14}C dating, medical, agricultural and industrial applications of isotopes.

RADIATION CHEMISTRY

Interaction of matter with radiation, radiation dosimetry-units and measurement of chemical dosimeters (Fricke and ceric sulphate dosimeters), radiation chemistry of water, a brief introduction to radiolysis of liquids and solids, industrial applications of radiation chemistry (radiation polymerization, food irradiation and radiation synthesis).

Health and Safety Aspects: Biological effects of radiation, hazards in radiochemical work, radiation protection, decontamination procedures, permissible exposure doses, nuclear waste management including waste storage and disposal procedures.

Self study: Safety measures from radiation field
Skill component: Measuring the radioactivity present in standard sample using GM counter OR construct the Fricke dosimeter and measure the absorbed radiation.

REFERENCE BOOKS:

01. Symmetry and Spectroscopy of Molecules by K. Veera Reddy.
02. Chemical Applications of Group Theory by F. A. Cotton.
03. Symmetry and Group theory by P. K. Bhattacharya.
04. Inorganic Chemistry: Principles, structure and reactivity, 1997, J. E. Huheey, Keiter and Keiter.
05. Inorganic Chemistry, 3rd edition, C. E. Housecroft and A. G. Sharpe.
06. Inorganic Chemistry by Purcel and Kotz.
07. Inorganic Chemistry by W. W. Porterfield.
08. Concepts and Models of Inorganic chemistry by Douglass, Alexander and Mcdaniel.
09. Inorganic Chemistry by Miessler and Tarr.
10. Introduction to Solids by Azaroff.
11. Solid State Chemistry and its Applications by Anthony R. West.
12. Solid State Chemistry: An Introduction, 3rd edition, Lesley E. Smart and Elaine A. Moore.
13. Fundamental concepts of Inorganic Chemistry by A. K. Das, volume 1 to 7.
14. Essentials of Nuclear Chemistry by H.J. Arnikar, Eastern Wiley (1990).
15. Nuclear Chemistry by U.N. Dash, Sultan Chand and Sons (1991).
16. Nuclear Chemistry by Friedlander and Kennedy, John Wiley and Sons (1987)

SECOND SEMESTER

Core Subject Code: 126MSC01CHESCC04L

Paper Title : CHIPr-2.6: INORGANIC CHEMISTRY PRACTICAL-II

Duration: 4 h/ week & Total: 64 h **Credits : 2**

Part A. Qualitative analysis:

Qualitative analysis of at least FIVE ternary mixtures containing one rare cation and one interfering anion.

Part B. Preparation of complexes:

01. $K_3[Al(C_2O_4)_3]$ $3H_2O$ & $[Cu(thiourea)_3]_2$ SO_4. H_2O
02. Estimation of Copper in tristhiourea copper (I) sulphate by Iodometric method

REFERENCES

REFERENCES: 1. Practical Inorganic Chemistry by Shikha Gulati, JL Sharma and Shagun Manocha, CBS Publication.
2. Vogel's Qualitative Analysis, Seventh edition, by Svehla G, Pearson India.
3. Inorganic qualitative analysis in the Laboratory, 1st edition, by Clyde Metz, Academic Press.
4. W. L. Jolly, Modern Inorganic Chemistry, McGraw, Hill Co., 1984.
5. M. Day and J. Selbin, Theoretical Inorganic Chemistry, 2nd edition, Von. Nostrand, 1980.
6. H. J. Emeleus and J. J. Anderson, Modern Aspects of Inorganic Chemistry, Von. Nostrand, 1962.

SECOND SEMESTER

Core Subject Code: 126MSC01CHEHCC07T

Paper Title :CHOT-2.2: ORGANIC CHEMISTRY-II

Teaching: 4 h/ week & Credits : 4 **Total: 64 h**

UNIT-I **16 h**

NAMED REACTIONS

C-C bond forming reactions: Aldol condensation, Dickmann condensation, Stobbe condensation, Micheal addition, Perkin reaction, Reimer-Tiemann reaction, Reformtsky reaction, Wittig reaction, Mannich reaction, Shapario reaction.

C-N bond forming reactions: Chichibabin reaction, Barton reaction, Hofmann-Loffler-Freytag reaction, Stork enamine reaction.

C-O bond forming reactions: Sharpless asymmetric epoxidation, Bayer-Villeger reaction.

C-Cl bond forming reaction: Hell-Volhard-Zelinski reaction.

Self study(SS): Basic of reaction mechanisms, addition, substitution and rearrangement reactions. Stereochemistry.

Skill components:Aldol condensation, Michel addition & HVZ reaction products are analyzed by spectroscopic (FT-IR, UV-Vis and NMR spectroscopy) available from online sources.

UNIT-II **16 h**

OXIDATION AND REDUCTION REACTIONS

Oxidation reactions: Introduction,Oxidation reactions examples and applications of chromium series-$K_2Cr_2O_7$, PDC, PCC, Sorret and Jones reagents. Manganese compounds-$KMnO_4$, MnO_2.

Oxidation reactions involving ozone, peracids, lead tetraacetatate, periodic acid, osmanium tetroxide, selenium dioxide, Oppenauer oxidation.

Reduction reactions: Introduction, Catalytic hydrogenation-both heterogeneous (examples Nickel and palladium) and homogeneous, metal hydride reductions (NaBH4 and LiAlH4), reduction with dissolved metal, diimide reduction, Clemmensen, Wolf Kishner, Meerwin-Varley-Ponndorf reduction, Leukart reaction and reductions with diborane.

Self study(SS):Basics of oxidation and reduction, calculation of oxidation number, oxidizing and reducing agents with examples.

Skill components(SC):Oxidizing and reducing agents are identified with model reaction (two examples), and monitor reaction using TLC, UV-Vis and FT-IR.

UNIT -III **16 h**

REARRANGEMENT REACTIONS

Classification and general mechanistic treatment of nucleophilic, electrophilic and free radical rearrangements.

Rearrangement reactions involving migration to electron deficient carbon: Wolf, Wagner-Meerwein, Pinacol-pinacolone and Benzil-benzilic acid rearrangement.

Rearrangement reactions involving migration to electron rich carbon: Favorskii, Sommlet-Houser, Naber and Steven rearrangement.
Rearrangement reactions involving migration to electron deficient nitrogen: Hoffmann, Lossen, Curtius, Schmidt, Beckmann rearrangement.
Rearrangement reactions involving migration to electron deficient oxygen: Dakin, Bayer- Villiger and Hydroperoxide rearrangement.

Self study: Basics of rearrangement, nucleophiles, electrophiles and free radicals with examples, migration and rearrangement of atoms, electron rich and electron deficient atoms.
Skill components(SC):Students need to give one nucleophilic, electrophilic & free radical rearrangement reactions with suitable examples, analyzereactants and products using spectral data (record/online source).

UNIT-IV **16 h**

HETEROCYCLIC COMPOUNDS

Nomenclature of heterocyclic compounds-Hantz-Wiedamann system.
Synthesis and reactions of
3- Membered heterocyclic compounds – aziridines, azirines, oxiranes, oxirenes and thiiranes.
4- Membered heterocyclic compounds with one and two hetero atoms – azitidines, oxetanes and thietanes
6- Membered heterocyclic compounds with one and two hetero atoms – pyridine, pyrimidine, quinoline.
7- Membered heterocyclic compounds – azepines, oxepines, thiepines.

Self study(SS): Basics of heterocyclic compounds, nomenclature and examples, aromatic, non-aromatic and anti-aromatic compounds.
Skill components(SC):List out each heterocyclic ring contain drug molecule (one each) and give its biological applications with mechanism/mode of action.

REFERENCE BOOKS:

01. Understanding organic reaction mechanisms, A. Jacob, Cambridge Univ. Press, 1997.
02. Introduction to organic chemistry A. Streitweiser, Jr and C. H. Heathcock, Macmillan, 1985.
03. Physical and mechanistic organic chemistry, R.A.Y. Jones, 1st Edn. Cambridge Univ. Press, 1979.
04. Mechanisms of molecular migrations, Vols I and II, B. S. Thiagarajan, 1st Edn. Pergamon Press, Oxford, 1979.
05. P. J. Garratt in Comprehensive organic chemistry, D. Barton and W. D. Ollis, 1st Edn. Pergamon Press, Oxford, 1979.
06. Radicals in organic synthesis, B. Giese, Pergamon Press, 1986.

07. Stereoelectronic effects in organic chemistry, P. Deslongchamps, 1st Edn. Pergamon Press, 1983.
08. Organic photochemistry, J. M. Coxon and B. Halton, 1st Edn, Cambridge Univ. Press, London, 1974.
09. Molecular reactions and photochemistry, C. H. Deputy and D. S. Chapman, 1st Edn. Prentice-hall India, New Delhi, 1972.
10. Stereochemistry of carbon compounds, E. L. Eliel, S. H. Wilen and L. N. Mander, John Wiley & Sons, 1994.
11. Stereochemistry, Potapov, MIR, Moscow, 1984.
12. Stereochemistry, Nasipuri, D, New Age, 1999.
13. Advanced organic chemistry, J. March, 4th Edn. John Wiley, 2008.
14. Organic Chemistry, R. E. Ireland Prentice-Hall India, New Delhi, 1975.
15. Some modern methods of Organic Synthesis, W. Caruthers, Cambridge Uni. Press London, 2nd Edn. 1998.
16. Stereochemistry of organic compounds- Principle and applications, D. Nasipuri, 2nd Edn., New Age International Publishers, 2001.

SECOND SEMESTER

Core Subject Code: 126MSC01CHESCC05L

Paper Title : CHOPr-2.7: ORGANIC CHEMISTRY PRACTICAL-II

Duration: 4 h/ week & Total: 64 h **Credits : 2**

ANALYSIS OF BINARY ORGANIC MIXTURE

Systematic qualitative analysis of binary mixture (solid+solid, solid+ liquid)
Chemical equations to be discussed for all tests.

PART-B

Fractional crystallization: Separation of mixture of naphthalene and biphenyl.
Fractional distillation: Separation of Mixture of benzene and toluene.
Thin layer chromatography: Separation of plant pigments.
Column chromatography: Separation of mixture of O & P-nitroanilines.

NOTE: Only experiments in PART-A are to be given in Practical Examination.

REFERENCES

01. Vogel's Text Book of Practical Organic Chemistry Furniss, Hannaford, Smith and Tatchell, ELBS Longmann
02. Advanced Practical Organic Chemistry N.K. Vishnoi, Vikas, Publishing House
03. Handbook of Practical Organic Chemistry Clark
04. Practical Organic Chemistry O.P. Agra

SECOND SEMESTER

Core Subject Code: 126MSC02CHEHCC08T

Paper Title : CHPT-2.3: PHYSICAL CHEMISTRY-II

Teaching: 4 h/ week & Credits : 4 **Total: 64 h**

UNIT-I **16 h**

QUANTUM CHEMISTRY-II

One dimensional simple harmonic oscillator in classical mechanics and quantum mechanics, wave functions of the harmonic oscillators, the applications of Schrödinger's equations to the H atom derivation (separation of R, θ, φ equations and their solutions). Quantum number and their characteristics. Approximate methods in quantum mechanics, variations method, linear and non linear variation functions, application to the He atom, ant symmetric and asymmetric exclusion principle, Slater's determination wave functions, terms symbols and spectroscopic status. Hydrogen like wave functions, angular and radial wave functions and its application to hydrogen atom, general equation and general determination, application of variation method to hydrogen molecule, ion and normal and degenerate states, Orbital diagram need for variation methods. Perturbation theory, first and second order perturbation theory and its application to linear harmonic oscillator.

Skill development: Brief explanation and experimental results on Density Functional Theory (DFT).

UNIT-II **6 h**

STATISTICAL THERMODYNAMICS-II

Statistical thermodynamics: Introduction to statistical thermodynamics, energy states, quantum mechanical and statistical aspects, unit cells, microscopic state and macroscopic state, phase space, system, assembly and ensemble, use of ensemble, microcononical ensemble, canonical ensemble, probability, thermodynamic probability, molecular basis of residual entropy.

Classical statistics, Sterling's approximation, Maxwell Boltzmann distribution law and its applications. Bose-Einstein statistics, Fermi-direc statistics and their comparisons. Derive the relationship between entropy and thermodynamic probability, partition function, thermodynamic functions in terms of partition function (energy, heat capacity, entropy, Gibb's free energy, enthalpy Helmholtz free energy). Evaluation of different types of partition function. i) Translational partition function. Ii) Rotational partition function for diatomic molecule iii) vibrational partition function for diatomic molecule ,electronic partition function iv) nuclear partition function, separation of partition function, residual entropy (problems to be solved).

Skill development: Plotting of radial wave functions using origin software

UNIT-III **16 h**

CHEMICAL KINETICS: Complex reactions: Kinetics of parallel, consecutive and reversible reactions. Chain reactions: Branched chain reactions, general rate expression, Auto catalytic reactions (Hydrogen-Oxygen reaction), oscillatory reactions and explosion limits. Theories of reaction rates: Collision theory and its limitations, Activated complex theory (postulates -derivation) and its applications to

reactions in solution. Energy of activation, other activation parameters - determinations and their significance. Lindemann theory, Hinshelwood's theory of unimolecular reactions. Potential energy surfaces: Features and construction, theoretical calculations of Ea.

Reactions in solution: Ionic reactions - salt effects, effect of dielectric constant (single and double sphere models). Effect of pressure, volume and entropy change on the rates of reactions. Cage effect with an example. Fast reactions- Introduction, study of fast reactions by continuous and stopped flow techniques, relaxation methods (T-jump and P-jump methods), flash photolysis, pulse and shock tube methods.

Skill development: Kinetics Studies of the Bleaching of Food Dyes

UNIT-IV **16 h**

PHOTOCHEMISTRY AND PHOTODEGRADATION

PHOTOCHEMISTRY: Electronic transitions in molecules, The Franck-Condon principle, electronically excited molecules - singlet and triplet states. Life times of excited states of atoms and molecules. Quantum yield and its determination. Actinometry – ferrioxalate, uranyl oxalate, MGL and Reinekke's salt actinometers.

A review of laws of photochemistry –Grottus-Draper law, Beer-Lambert law, Stark-Einstein law. Photo physical processes – kinetics of unimolecular reactions, experiments in photochemistry, photo properties - fluorescence, phosphorescence, chemiluminescence. Delayed fluorescence – E-type and P-type. State diagrams, Stern-Volmer equation (to be derived), lasers in photochemical kinetic studies, photo electrochemistry, solar energy conversion and storage.

Photochemical processes – types of photochemical reactions – electron transfer, photo dissociation, oxidation and isomerization reactions with examples. Photosensitization. Flash photolysis.

PHOTODEGRADATION: Photocatalyst – ZnO, TiO_2, solar cells, principle, application of ZnO/TiO_2 in the photo degradation of dyes (IC), pesticides (DDT) and in industrial effluents. Nature of dyes used in Dye-sensitized solar cells.

Skill development: Degradation of Methylene blue using ZnO or TiO_2 nano semiconductors.

REFERENCE BOOKS:

01. Statistical themodynamics by B.C. Meclelland, Chapman and Hall, London (1973).
02. Text book of Physical Chemistry by Samuel Glasstone, MacMillan Indian Ltd., 2 nd edition, (1974).
03. Thermodynamics –Rajaram and Kunakose,East West, Nagin Cx,Dehli,1986.
04. An introduction to Chemical Thermodynamics–R.P.Rastogi and S.S.Misra,Vikash,Delhi,1978.
05. Introductory Quantum Mechanics – Atkins ,Claredon,Oxford
06. Quantum chemistry-Kauzman,Academic Press,1957.
07. Quantum chemistry-R.K.Prasad ,II.Ed,New Age Int-2000.

08. Physical chemistry-Atkins,ELRS,1982.
09. Physical chemistry –Moore,Orient Longman,1972.
10. Quantum Chemistry – Eyring, Walter and Kimball. John Wiley and Sons, Inc., New York.
11. Theoretical Chemistry – S. Glasstone. East West Press, New Delhi, (1973).
12. Quantum Chemistry – R.K. Prasad, New Age International Publishers (1996).

SECOND SEMESTER

Core Subject Code: 126MSC02CHESCC06L

Paper Title : CHPPr-2.8: PHYSICAL CHEMISTRY PRACTICALS-II

Duration: 4 h/ week & Total: 64 h **Credits : 2**

Chemical Kinetics

- **a.** Determine the specific reaction rate of potassium persulphate-iodide reaction by initial rate method.
- **b.** Study the kinetics of the iodination of acetone in the presence of acid by initial rate method.
- **c.** Study the acid catalyzed inversion of cane sugar and find out: (i) the order with respect to sucrose, (ii)the rate constant, (iii)compare kinetically strength of two acids(HCL and H_2SO_4).
- **d.** Study of kinetics of autocatalytic reaction between KMnO4 versus oxalic acid.
- **e.** Evaluation of Arrehenius parameter for the reaction between $K_2S_2O_8$ versus KI (first order)

pH metery:

a. Determination of degree of hydrolysis of aniline hydrochloride at room temperature and calculation of dissociation constant of the base by pH metry.
b. Determination of pH of acetic acid with sodium acetate buffer by pH metry method.
c. Determination of pH of formic acid with sodium formate buffer by pH metry method.

Colorimetric:

a. Determination of dissociation constant of a given indicator by colorimetric method.
b. Verification of Beers lamberts law by colarimetric method and calculation of molar extinction co-efficient (molar absorption co-efficient)
c. To construct the calibration curve Fe^{2+}-KCNS and Cu^{2+}-NH_3 systems and estimate the amount of respective salt present in a given solution by colarimetrically

REFERENCE BOOKS:

01. Selected Experiments in Physical Chemistry – Latham.
02. Experiments in Physical Chemistry – James and Prichard.
03. Experiments in Physical Chemistry – Shoemaker.
04. Advanced Physico-Chemical Experiments –J. Rose
05. Experimental Inorganic/Physical Chemistry- Mounir A. Malati.
06. Quantitative Chemical Analysis – Daniel C. Harris, (2006) 7th edition.
07. Spectrophotometric determination of elements – Z. Marczenko

SECOND SEMESTER

Soft Core Code: 126MSC02CHEHCC09T

Paper Title : CHGT-2.4: SPECTROSCOPY-II

Teaching: 2 h/ week & Credits : 2 **Total: 32 h**

UNIT-I **16 h**

NUCLEAR MAGNETIC RESONANCE SPECTROSCOPY

Magnetic properties of nuclei (magnetic moment, g factor, nuclear spin), effectof external magnetic field on spinning nuclei, Larmor precessional frequency, resonance conditions, population of nuclear magnetic energy levels, relaxation processes, relaxation time, line width and other factors affecting line width.

Chemical shift, reference standards employed in NMR, factors influencing chemical shift-electronegativity(shielding and deshielding), anisotropic effect, vander Walls deshielding, effect of restricted rotation, H-bonding.

Nature of protons bonded to carbon and other nuclei, Proon integrals, spin-spin coupling-coupling constant, types of coupling, Karplus equations-variation of coupling constants with dihedral angle.

Instrumentation-Frequency sweep instruments, field sweep instruments and pulsed FT-NMR instruments, Chemical equivalence and magnetic equivalence, proton exchange reactions.

First order spectra, non first order spectra, simplification of complex spectra-increasing magneticfield strength, double resonance, deuterium exchange reactions, and lanthanide shift reagents. Nuclear Overhauser Effect (NOE), variable temperature probe.

^{13}C-NMR Spectroscopy: Comparison of ^{1}H-NMR and ^{13}C-NMR, proton decoupling or noise decoupling or broad band decoupling, chemical shift positions of carbon atoms in organic molecules.

Two dimensional NMR Spectroscopy: COSY, NOESY, DEPT Spectra and MRI.

Self study (SS): Basic of spectroscopy, Electromagnetic radiation, nuclear spin, NMR solvent, theory of NMR.

Skill component (SC):Download NMR spectra of simple molecules: C2H5OH, CH3-CO-CH3, C6H6, CH3OH and CH3CH2CH2OH, analyse ^{1}H, ^{13}C and 2D NMR data.

UNIT-II **16 h**

MASS SPECTROMETRY

Introduction, basic theory, instrumentation-single focusing, double focusing, quadrupole mass filter, TOF instruments. Methods of generation of positively charged ions-electron impact ionization, chemical ionization, fast atom bombardment(FAB), matrix assisted laser desorption ionization.

Resolving power, base peak, molecular ion peak, meta stable peak, isotopic peaks-calculation of percentage intensity of (m+1) and (m+2) peaks.Exact molecular mass, molecular formula, hydrogen deficiency index, preliminary analysis of structure.

Modes of fragmentation- fragmentation rules, McLafferty rearrangement, retro Diels-Alder reaction, ortho effect, fragmentation of following class of organic compounds – alkanes, alkenes, alcohols, aldehydes, ketones, carboxylic acids, amino compounds.

Combined applications of spectroscopic techniques

Combined applications of IR, UV-Visible, ^{1}H NMR, ^{13}C NMR and Mass spectrometry in the structural elucidation of organic compounds.

01. Structure analysis when spectral data of the organic compound is given
02. Structure analysis when spectra of organic compound are given

Self study (SS):Origin of mass spectrometry, ionization, principle, types of detector.
Skill component (SC):Download some six simple different functional group contain compounds and analyse fragmentation pattern and justify how this help for structure elucidation of new compounds.

REFERENCE BOOKS:

01. Fundamentals of Molecular Spectroscopy, C. N. Banwell and E. M. McCash. 4th edition, Tata McGraw-Hill, New Delhi.
02. Introduction to Molecular Spectroscopy, G. M. Barrow, McGraw-Hill, New York.
03. Introduction to Spectroscopy. Pavia, Lampman and Kriz, 3rd edition, Thomson.
04. Spectroscopy, B. P. Straughan and S. Walker, John Wiley & Sons Inc., New York, Vol. 1 & 2, 1976.
05. Vibration Spectroscopy Theory and Applications, D. N. Satyanarayana, New age International, New Delhi.
06. Organic Spectroscopy, William Kemp, 3rd edition, Palgrava, 1991.
07. Optical Method of Analysis, E. D. Olsen, McGraw Hill Inc, 1975.
08. Spectroscopy of organic compounds – P. S. Kalasi, Wiley Eastern Ltd, India 1993.
09. Introduction to instrumental analysis – R. D. Braun, McGraw Hill Book company 1982.
10. Physical methods in inorganic chemistry – R. Drago, East West Pvt. Ltd, 1968.
11. Instrumental methods of chemical analysis – Gurdeep Chatwal and Anand.
12. Organic Spectroscopy, 2nd edition– Jag Mohan, Narosa Publishing House New Delhi.
13. Applications of IR and Raman spectroscopy to coordination and organometallic compounds, K. Nakamoto.

SECOND SEMESTER

Open Elective Code: 126MSC02CHEOEC01T

Paper Title : CHEG-2.5: CHEMISTRY FOR EVERY DAY LIFE

[OPEN ELECTIVE]
Teaching: 4 h/ week & Credits : 4 **Total: 64 h**

UNIT-I **16 h**

POLLUTION

Air pollution: Air pollutants, prevention and control, green house gases and acid rain, ozone hole and CFC's, photochemical smog and PAN, catalytic converters for mobile sources, Bhopal gas tragedy.

Hydrologic cycle, sources, criteria and standards of water quality-safe drinking water, public health significance and measurement of water quality parameters-(colour, turbidity, total solids, acidity, alkalinity, hardness, sulphate, fluoride, phosphate, nitrite, nitrate, BOD and COD), water purification for drinking and industrial purposes.

Toxic chemicals in the environment.

Detergents- pollution aspects, eutrophication. Pesticides and insecticides- pollution aspects, heavy metal pollution, solid pollutants -treatment and disposal, treatment of industrial liquid wastes. Sewage and industrial effluent treatment.

Oils and fats: Composition of edible oils, detection of purity, rancidity of fats and oil, estimation of rancidity, tests for common edible oils Tests for adulterants like aregemone oil and mineral oils.

UNIT-II **16 h**

INDUSTRIAL CHEMISTRY

Composition of soil - inorganic and organic components in soil- micro and macro nutrients.

Fertilizers: Classification of Fertilizers- straight fertilizers, compound/complex fertilizers, fertilizer mixtures, manufacture and general properties of fertilizer products-Urea and DAP.

Ceramics: general properties, porous and non-porous wares, Manufacturing process, extrusion, turning, drying, decoration, Porcelain and china.

Cement: Types, manufacture, additives, setting, properties & testing of cement.

Glass: Manufacture, properties, shaping of sheets & plate glasses. Annealing, finishing. special glasses.

Paints and Pigments: White pigments (white lead, ZnO, lithopone, titanium dioxide), blue, red, yellow and green pigments. paints and distempers, requirements of a good paint, emulsion, latex, luminescent paints, fire retardant paints, varnishes, enamels, lacquers, solvents and thinners.

UNIT-III **16 h**

BIOORGANIC COMPOUNDS

Carbohydrates: Chemistry of important derivatives of monosaccharides - ethers, esters, acetals, ketals, deoxysugars and aminosugars.

Vitamins: Classification and Nomenclature. Source and deficiency diseases, biological functions of Vitamins- Vitamin A_2, Vitamin B, Vitamin C, Vitamin D & Vitamin K.

Food Analysis: Dairy products- composition of milk and milk products, analysis of fat content, minerals in milk and butter, Estimation of added water in milk.
Beverages: Analysis of caffeine in coffee and tea, detection of chicory in coffee, chloral hydrate in toddy, estimation of methyl alcohol in alcoholic beverages.
Food additives, adulterants and contaminants- Food preservatives like benzoates, propionates, sorbates, bisulphites, artificial sweeteners like saccharin, dulcin and sodium cyclamate.
Flavours: vanillin, esters (fruit flavours) and monosodium glutamate. Artificial food colourants - coal tar dyes and non-permitted colours and metallic salts. Pesticide residues in food.
Drugs: Classification and nomenclature. Analgesics - aspirin, paracetamol; Anthelmentics – mebendazole, Antiallergics - chloropheneramine malleate.
Antibiotics: Pencillin, chloromycetin and streptomycin.

UNIT-IV **16 h**

INDUSTRIAL ORGANIC CHEMISTRY

Chemical energy systems and limitations, principles and applications of primary and secondary batteries and fuel cells, Basics of solar energy, Energy storage devices, Polymers in everyday life: from buckets to rockets: types and classification of polymers, source and general characteristics of natural and synthetic polymers, typical examples of polymers used as commodity plastics, textiles, electronic and automobile components, medical and aerospace materials, problems of plastic waste management, strategies for development of environmental friendly polymers.
Dyes: Colour and constitution (electronic concept). Classification of dyes, methods of applying dyes to the fabrics. A general study of Azo dyes, Orange –II, Mordant brown, Congo red and methyl orange.
Corrosion: Types and prevention, corrosion failure and analysis.

REFERENCE BOOKS:

01. B.K. Sharma: introduction to Industrial Chemistry, Goel Publishing, Meerut(1998).
02. Medicinal Chemistry by Asthoush Kar.
03. Drugs and Pharmaceutical Sciences Series, Marcel Dekker, Vol.II, INC, New York.
04. Analysis of Foods – H.E. Cox; 13. Chemical Analysis of Foods- H.E. Cox and Pearson.
05. Foods – Facts and Principles. N. Shakuntala Many and S. Swamy, 4th ed. New Age Internatl (1998).
06. Physical Chemistry – P. Atkins and J. de Paula -7 th Ed. 2002, Oxford University Press
07. Handbook on Fertilizer Technology by Swaminathan and Goswamy, 6 th ed. 2001, FAI.
08. Organic Chemistry by I. L. Finar, Vol. 1 & 2
09. Polymer Science and Technology, J. R. Fried

Question paper Pattern of 4 Credit Paper

_ Semester (Regular/ Repeater) M.Sc. Degree (CBCS) Examination, June/July-20xx

CHEMISTRY

Paper Code: Subject

Time : 3 Hours Max. Marks : 80

*Instructions: Answer **all** questions*

1. Answer **any eight** of the following questions. (8x2 = 16)
   a)
   b)
   c)
   d)
   e)
   f)
   g)
   h)
   i)
   j)

2. a)
   b)
   c)

   OR

   d) (5+5+6)

3. a)
   b)
   c)

   OR

   d) (5+5+6)

4. a)
   b)
   c)

   OR

   d) (5+5+6)

5. a)
   b)
   c)

   OR

   d) (5+5+6)

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Question paper Pattern of 2 Credit Paper

_ Semester (Regular/ Repeater) M.Sc. Degree (CBCS) Examination, June/July-20xx

CHEMISTRY

Paper CHGT-x: Spectroscopy-x

Time : 2 Hours Max. Marks : 40

*Instructions: Answer **all** questions*

1. Answer **any four** of the following questions. (4x2 = 8)
   a)
   b)
   c)
   d)
   e)
   f)

2. a)
   b)
   c)

   OR

   d) (5+5+6)

3. a)
   b)
   c)

   OR

   d) (5+5+6)

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