

ಮಂಗಳೂರು
MANGALORE



ವಿಶ್ವವಿದ್ಯಾನಿಲಯ
UNIVERSITY

(Accredited by NAAC with 'A' Grade)

ಕ್ರಮಾಂಕ/No: MU/ACC/CR.14/2018-19/A8

ಕುಲಸಚಿವರ ಕಛೇರಿ

ಮಂಗಳಗಂಗೋತ್ರಿ - 574 199

Office of the Registrar

Mangalagangothri - 574 199

ದಿನಾಂಕ/Date: 13.01.2020

NOTIFICATION

Sub: Revised syllabus of Chemistry as a core course for B.Sc degree programme under choice board credit system.

Ref: Decision of the Academic council at its meeting held on 18.12.2019 vide Agenda No: 3:04(2019-20)

The Revised syllabus of Chemistry as a core course for B.Sc degree programme which was approved by the Academic council at its meeting held on 18.12.2019 is hereby notified for implementation with effect from the Academic year 2020-21

Copy of the syllabus shall be downloaded from the Mangalore University website www.mangaloreuniversity.ac.in

REGISTRAR.

To:

- 1) The Principals of the Colleges concerned.
- 2) The Registrar (Evaluation), Mangalore University.
- 3) Prof. Balakrishna Kalluraya, Chairman, U.G&PG BOS in Chemistry, Department of Chemistry, Mangalore University.
- 4) The Superintendent, Academic Section, O/o the Registrar, Mangalore University.
- 5) The Director, DUIMS, Mangalore University - with a request to publish in the Website.
- 6) Guard File.

MANGALORE UNIVESITY
CHOICE BASED CREDIT SYSTEM
COURSE PATTERN AND SCHEME OF EXAMINATION
CORE SUBJECT: CHEMISTRY

Core/ Elective	Paper Code	Title of the Paper	Instructi on Hours	Duration of the Examinati on(Hrs.)	Max. Marks			Cre dits
					Exam	IA	Total	
I Semester B.Sc.								
Group I Core Subject	Theory BSCCHC131	Chemistry Paper I	4	3	80	20	100	2
	Practical I BSCCHP132	Chemistry Practical I	3	3	40	10	50	1
Group II Elective	Theory BSCCHCE 133	Laboratory Reagents, Laboratory Safety and Domestic Chemicals	2	2	40	10	50	1*
Total number of Credits for Subject in I Semester:04								
II Semester B.Sc.								
Group I Core Subject	Theory BSCCHC181	Chemistry Paper II	4	3	80	20	100	2
	Practical II BSCCHP182	Chemistry Practical II	3	3	40	10	50	1
Group II Elective	Theory BSCCHCE 183	Biomolecules And computer for chemists	2	2	40	10	50	1*
Total number of Credits for Subject in II Semester:04								
III Semester B.Sc.								
Group I Core Subject	Theory BSCCHC231	Chemistry Paper III	4	3	80	20	100	2
	Practical III BSCCHP232	Chemistry Practical III	3	3	40	10	50	1
Group II Elective	Theory BSCCHCE233	Chemistry and Environment	2	2	40	10	50	1*
Total number of Credits for Subject in III Semester:04								
IV Semester B.Sc.								
Group I Core Subject	Theory BSCCHC281	Chemistry Paper IV	4	3	80	20	100	2
	Practical IV BSCCHP282	Chemistry Practical IV	3	3	40	10	50	1
Group II Elective	Theory BSCCHOE283	Chemistry in everyday life	2	2	40	10	50	1*
Total number of Credits for Subject in IV Semester:04								
V Semester B.Sc.								
Group I Core Subject	Theory BSCCHC331	Chemistry Paper V	3	3	80	20	100	2
	Theory BSCCHC332	Chemistry Paper VI	3	3	80	20	100	2
	Practical V BSCCHP333	Chemistry Practical V	4	4	80	20	100	2
Total number of Credits for Subject in V Semester:06								

VI Semester B.Sc.								
Group I Core Subject	Theory BSCCHC381	Chemistry Paper VII	3	3	80	20	100	2
	Theory BSCCHC382	Chemistry Paper VIII	3	3	80	20	100	2
	Practical VI BSCCHP383	Chemistry Practical VI	4	4	80	20	100	2
Total number of Credits for Subject in I Semester to IV Semester:16								
Total number of Credits for Core Subject in I-VI Semesters:28								

*Credits for Elective Papers will be considered for the entire B.Sc.

BASIS FOR INTERNAL ASSESSMENT, PATTERN OF THEORY QUESTION PAPERS AND PRACTICAL EXAMINATION IN SCIENCE SUBJECTS

1. Basis of Internal Assessment in Theory and Practical's

The internal assessment marks in theory papers shall be based on two tests. The tests shall be at least 1 hour duration each and to be conducted after 6 and 12 weeks after the start of a semester. The average of the two tests shall be taken as the internal assessment marks in theory papers.

The practical internal assessment marks shall be based on one test and continuous evaluation during the practicals. The practical test shall be conducted after 10 weeks after the start of a semester. The average of the test and continuous evaluation shall be taken as the internal assessment marks in practicals.

2. Theory Question Papers Pattern:

Theory Question Papers in Chemistry shall carry 80 marks. The syllabus of each paper is grouped into four (4) units of 13 teaching hours each in the first 4 semesters and 10 teaching hours each in the 5th and 6th semesters for all the science subjects with practical's. The Question Paper shall consist of Parts A and B, as detailed below.

Part A: Part A Shall contain 12 objective type questions/divisions (Q.No 1) drawn from all the 4 units of the syllabus (3 divisions per unit) carrying 2 marks each (a,b,c,d,e,f,g,h,i,j,k & l). 10 divisions are to be answered $10 \times 2 = 20$ marks.

Part B: Part B shall contain eight (8) brief and long answer questions (Q. Nos 2 to 9) carrying 15 marks each drawn from all the four units of the syllabus (2 questions per units). There shall be three divisions per question. The students are required to answer 4 full questions, choosing one full question from each unit. $4 \times 15 = 60$ marks.

3. Question paper for Soft core/open elective papers:

The question paper shall carry 40 marks. The question paper shall consist of Part A and Part B as detailed below.

Part A : Part A shall contain 6 objective type questions/divisions (Q.No.1) drawn 3 divisions from each Unit. (Unit-I and Unit-II) carrying 2 marks each (a,b,c,d,e,f). 5 division are to be answered. $5 \times 2 = 10$ marks.

Part B: Part B shall contain four (4) brief and long answer questions (Q.No.2 to 5) carrying 15 marks each drawn from two units of the syllabus (2 questions per units). There shall be three divisions per question. The students are required to answer 2 full questions, choosing one full question from each unit. $2 \times 15 = 30$ marks.

	UNIT I		UNIT II		UNIT III		UNIT IV	
Q. Nos. (Max. Marks 15)	2	3	4	5	6	7	8	9
Marks Splitting	4+4+7 (4+3)	3+5+7 (4+3)	4+4+7 (4+3)	3+5+7 (4+3)	4+4+7 (4+3)	3+5+7 (4+3)	4+4+7 (4+3)	3+5+7 (4+3)

I Semester
B.Sc CHC-131: Chemistry Paper-I
UNIT I

Solid State

7Hours

Laws of crystallography: Law of constancy of interfacial angle-explanation taking hexagonal crystal system as an example. Law of symmetry. Elements of symmetry- axis of symmetry, plane of symmetry and centre of symmetry-explanation taking cubic crystal system as an example. Law of rationality of indices. Miller indices- calculation of Miller indices for different planes in a cubic crystal system. Bravais lattices. X-ray diffraction by crystals. Derivation of Bragg's equation. Determination of crystal structure of NaCl and determination of Avogadro number. Caesium Chloride, Zinc blende structures(Numerical problems to be discussed).

Liquid Crystals

2Hours

Explanation, classification with examples - smectic, nematic, cholesteric, disc shaped and polymeric. Structures of nematic and cholesteric phases- molecular arrangements in nematic and cholesteric liquid crystals. Application of liquid crystals in LCDs and thermal sensing.

Gaseous State

4Hours

Maxwell's distribution of molecular velocities- explanation with graph. Most probable, average and RMS velocities. Relation between RMS, average and most probable velocity. Qualitative discussion of the collision number, mean free path and collision diameter. Critical phenomena: P-V isotherms of real gases - Andrews's isotherms of carbon dioxide. Continuity of states - principles. Isotherms of Van der Waals equation. Relationship between critical constants and Van der Waals constants-derivation of the expressions for a , b , T_C , P_C and V_C , Law of corresponding states- statement, reduced equation of state-derivation of the equation.

UNIT II

Chemical Bonding

13Hours

Covalent bond-Valence bond theory-Concept of hybridization, Valence Shell Election Pair Repulsion (VSEPR) theory, Comparative study of structure and bonding between F_2O and H_2O , H_2S and H_2O , NH_3 and NF_3 , ClF_3 and $XeOF_2$. Basic principle of Molecular orbital theory. Molecular orbital diagrams of homo and hetero nuclear species- N_2 , O_2 , CO , NO and CN . Ionic bond- Lattice energy, Born-Lande equation, Solvation and Solubility of ionic solids. Polarising power and Polarizability of ions. Fajan's rules to explain bond character, covalent character of ionic compounds, relative covalent character. Comparative trend in properties: a) Melting point-e.g: $NaBr$, $MgBr_2$, $AlBr_3$; LiF , $LiCl$, $LiBr$, LiI ; $CaCl_2$,

HgCl₂ b) Solubility-e.g AgF, AgCl, AgBr, AgI c) Thermal stability-e.g BeCO₃ , MgCO₃ , CaCO₃ , SrCO₃ , BaCO₃. Metallic Bond-Application of Band theory.

UNIT III

Nature of Bonding In Organic Molecules: 3Hours

Formation of covalent bond. Types of Chemical bonding- Localised and Delocalised. Conjugation and Cross conjugation. Resonance. Aromaticity-Huckel rule, explanation with examples. Antiaromaticity. Hyper conjugation-relative stabilities of 1^o, 2^o and 3^o carbonations. Electron displacements in covalent bond. Inductive effect and Field effect - Explanation with examples. Relative strengths of aliphatic and aromatic carboxylic acids-Acetic acid and Chloroacetic acid, acetic acid and Propionic acid, Acetic acid and Benzoic acid. Steric effect- Relative stabilities of trans and cis-2-butene, relative reactivities of alkyl halides in S_N2 reaction, steric hindrance in esterification of acids and anomalous basic strength of tertiary alkyl amines.

Mechanism of Organic Reactions 7Hours

Breaking and making of covalent bonds. Substrate and reagent. Notations used to represent electron movements and directions of reactions- arrows, curved arrows, half-headed and double-headed arrows. Types of bond breaking-homolytic and heterolytic. Types of reagents-Electrophiles and Nucleophiles-explanation with examples. Types of organic reactions-Substitution, Addition, Elimination and Rearrangement reactions, explanation with examples. Reactive intermediates- Carbo cations, Carbanions, free radicals, carbenes, arynes and nitrenes- explanation with examples. Mechanism of – Friedel-Craft's reaction, Addition of HBr to propene, Free radical addition of HBr to propene, Cannizzaro reaction, Hofmann rearrangement, Addition of HCN and NaHSO₃ to carbonyl compounds.

Electrophilic Addition to Carbon-Carbon Multiple Bonds 3Hours

Addition of halogens to alkenes-carbocation and halonium ion mechanisms. Stereo specificity of halogen addition. Limitations of open carbocation mechanism. Ozonolysis – Mechanism of ozonolysis of propene. Addition of hydrogen halides to alkenes- mechanism, regioselectivity and relative rates of addition. Hydrogenation, hydration, hydroxylation and epoxidation of alkenes-Explanation with examples. Electrophilic addition to conjugated dienes-mechanism of addition of HBr to 1,3-butadiene, effect of temperature. Free radical addition to 1,3-butadiene. Diels-Alder reaction and its importance, 1,3-Dipolar cycloaddition and Pericyclic reaction-explanation with example.

UNIT IV

Chromatography 3Hours

Chromatographic methods for the separation, concentration and identification of organic compounds-Thin layer, paper and column chromatography. R_f value and its significance. Principle and applications of Gas chromatography.

Methods of Analysis 6Hours

Qualitative analysis - Sample size and techniques- macro, semi micro and micro. Type of tests- wet, dry and spot tests. Quantitative analysis - Volumetry, Gravimetry and Instrumental analytical methods. Principles of gravimetric analysis-methods of precipitation, optimum conditions for precipitation and co-precipitation. Solvent extraction-basic principles and applications. Errors in quantitative analysis, types of errors- determinate and indeterminate, methods of minimising errors. Accuracy - absolute error/ relative error. Precision -mean

deviation / relative mean deviation, standard deviation, t-test, F-test and Q-test. Significant figures. Rules for computation of results. (Numerical problems to be solved wherever necessary).

Periodic Properties

4Hours

Methods of determination of atomic properties -Atomic size by Lande's method, Ionization energy by Discharge tube method, Electron affinity from Born-Haber cycle and Electronegativity from Pauling and Mulliken scales. Predicting and explaining the chemical behaviour of elements on the basis of periodic properties (metallic/non metallic, ionic/covalent, reducing/oxidizing). Effective nuclear charge-shielding effect. Slater's rule and its applications.

BSCCHP132:CHEMISTRY PRACTICALS-I [3HOURS PER WEEK (12X3 =36)]

Volumetric Analysis

1. Microscale experiment-Two burette titration and beral pipette titration.
2. Preparation of standard sodium carbonate solution, standardization of hydrochloric acid and estimation of sodium hydroxide in solution.
3. Preparation of standard solution of potassium biphthalate, standardization of sodium hydroxide solution and estimation of hydrochloric acid in solution.
4. Preparation of a standard solution of oxalic acid, standardization of potassium permanganate solution and estimation of Mohr's salt in solution.
5. Preparation of standard ferrous ammonium sulphate solution, standardization of Potassium dichromate solution and estimation of ferric chloride in solution.
6. Preparation of standard potassium dichromate solution, standardization of sodium thiosulphate solution and estimation of copper sulphate in solution.
7. Estimation of a mixture of oxalic acid and sulphuric acid in a solution using standard Potassium permanganate solution and standard sodium hydroxide solution.
8. Estimation of calcium content in lime stone as calcium oxalate by permanganometry.
9. Estimation of hardness of water by EDTA method.
10. Estimation of manganese in pyrolusite by volumetric method.
11. Determination of acetic acid in commercial vinegar using NaOH.
12. Determination of alkali content in antacid tablet using HCl.
13. Estimation of glucose using iodine and sodium thiosulphate.
14. Estimation of Vitamin C.

Reference Books

1. A Text Book of Inorganic Chemistry-P.L.Soni.1998, Sultan Chand and Sons.
2. A Text Book of inorganic Chemistry-Puri and Sharma 2000, Shobanlal Nagin Chand.
3. A Text Book of inorganic Chemistry-Gurudeep Raj. Krishna's Educational Publishers.
4. A Text Book of inorganic Chemistry-Sathya Prakash, 2001.
5. A Text Book of Quantitative analysis- A.I_Vogel, ELBS.
6. Physical Chemistry by Samuel Glasstone, 1982 ELBS.
7. A Text Book of Physical Chemistry by P.L.Soni , O.P. Dharmarha and U.N.Dash, Sultan Chand and Sons.
8. Physical Chemistry-Madan and Tuli,2001, S.Chand. NEW DELHI.
9. A Text Book of Advanced Physical Chemistry-Gurudeep Raj 2001, Goel, Meerut

10. Organic Reaction mechanism by V.K.Ahluwalia and R.K.Parashar(Narosa Publishers).
11. Organic Chemistry by S.M.Mukherji, S.P.singh and R.K.Kapoor.(Narosa Publishers)
12. A Guide book to mechanism in Organic Chemistry by Peter sykes. Pearson.
13. Instrumental methods of Chemical analysis. Willard, Merritt, Dean and Skettle, CBS Publishers.
14. Instrumental methods of Chemical analysis -Gurudeep R.Chatval and Sham Anand, 1998, Himalaya Publishing House.

Group II Elective

B.Sc CHCE-133 : Laboratory Reagents, Laboratory Safety and Domestic Chemicals

UNIT I

Laboratory Safety

4Hours

Introduction. General laboratory protocols: Basic rules, Good Laboratory Practices. Chemical hazards, safety data sheets, symbols and hazard information, storage procedure, Physical hazards, Health hazards, Reaction hazards. Assessing the risks of hazards. Minimizing the risks of hazards: fume hood, ventilation, fire extinguisher, personal protective equipment's, Preparedness for emergencies from uncontrolled hazards: Importance of reporting incidents, response to common emergencies such as fires, explosions, chemical spills, chemical exposures, injuries.

Serendipity

3Hours

The role of Chance in making Scientific Discoveries

What is Serendipity- Some Serendipous Inventions in Science; Guncotton, Velcro, Plastic, X-rays, Microwave, Superglue, Mauve, Teflon, Saccharin, Stainless steel, Matches. Role of Serendipity in Drug discovery; Inventions in Chemistry that enabled the modern world.

Laboratory Reagents:

5Hours

Preparation of laboratory reagents and maintenance of electrodes and common laboratory equipments. Methods of expressing concentrations of solution, Preparation of reagents for qualitative analysis of organic and inorganic compounds. Precaution and safety measures during reagent preparation.

Unit-II

Domestic Chemicals

8Hours

Cleansing agents: Preparation Chemical composition of Soaps, detergents, dish washers, drain cleaners, bleaching powder, Tooth paste, mouth wash and shampoo. Stain removers – Explanation with some common examples.

Domestic items: Safety matches, Wax candles, shoe polish, mosquito coils, household germicides and pesticides-their chemical composition.

Cosmetics: Talcum powder, nail polish, thinners, skin care, hair care, Lipsticks, sun protection lotions and creams, eye shadow and eyebrow pencils, antiperspirants, perfumes and deodorants-explanation with examples.

Application Of Colloids

4Hours

Introduction, Applications: 1) Explanation of natural phenomena –Blue colour of sky, formation of delta region, coagulation blood 2) In industry- Purification of water, cleansing action of soap, tanning of leather, rubber plating, smoke precipitation, sewage disposal, ceramic industry, dyeing industry, preparation of photographic plates & paper., 3) Food. 4) In medicine 5) Artificial rain

Reference Books

1. Chemistry at Home: Exploring the ingredients in everyday products- John Emsley, Royal Society of Chemistry (2015).
2. Chemistry in daily life - Kripal Singh, Third Edition, Eastern Academy Education, PHI Learning Pvt. Ltd, New Delhi(2012).
3. Chemistry in everyday life-Shardendu Kislaya, Discovery Publishing House Pvt.Ltd(2011).
4. Laboratory Safety, theory and Practice, 1st Edition, Editors: Anthony Fuscaldo and others. Elsevier Publications, 1980.
5. Chemical Laboratory Safety and Security: A Guide to Developing Standard Operating Procedures. National Academies Press (2016). Board on Chemical Sciences and Technology, Division on Earth and Life Studies.
6. Chemistry Laboratory Safety Manual, Indian Institute of Science, Education and Research, Tirupati.
7. Laboratory Safety Manual, NCBS, 2016.
8. Practical Chemistry- Dr. O.P.Pandey, D.N. Bajpai, Dr. S. Giri
9. Vogel's Qualitative Inorganic Analysis- G. Svehla
10. Text book of Physical Chemistry By Puri, Sharma and Pathania
11. Science and serendipity: Famous accidental discoveries, Samira Shackle, Thursday, 2nd April 2015- New Humanist.
12. The role of serendipity in drug discovery. Thomas A. Ban, MD, FRCP- Dialogues in Clinical Neuroscience, 2006 Sep; 8(3): 335–344.
13. Five Chemistry Inventions that changed the modern world-The Conversation. June 2, 2015.
14. Hannan, Patrick J. (2006). Serendipity, Luck and Wisdom in Research; Universe. ISBN 0-595-36551-5.

II SEMESTER
B.Sc CHC-181 : Chemistry Paper-II
UNIT I

Chemical Kinetics : **4 Hours**

Concentration dependence of rates, differential rate laws of simple chemical reactions, Zero, First, Second, n^{th} and pseudo first order reaction. Derivation of rate constants for second order and n^{th} order reactions with equal initial concentrations. Determination of order of a reaction- Differential, Integration, Half life period and Isolation methods. Transition state theory- Derivation of relationship between rate constant and equilibrium constant. Thermodynamic aspects of activation.

Surface Chemistry: **4Hours**

Adsorption of gases on solids: Freundlich and Langmuir adsorption isotherms. Multilayer adsorption-BET equation. Determination of surface area and area of cross section of a molecule. Adsorption from solution-Gibb's Adsorption isotherm

Solvents: **5Hours**

Physical properties of a solvent - density, dipole moment, specific conductance, dielectric constant. Types of solvents - classification into protic - aprotic, acidic - basic - amphiprotic, ionizing - non ionizing (examples) solvents, Characteristics-liquid range, auto-ionization and solvating properties. Reactions in aqueous and non-aqueous solvents (explanation with examples). Water-hydration, hydrolysis, acid-base, reduction-oxidation, complex formation and precipitation. Ammonia-ammoniation, ammonolysis, acid-base, reduction-oxidation, complex formation, precipitation, alkali metals in ammonia. Levelling effect of solvents - examples.

UNIT II

s-Block Elements : **6Hours**

Hydrogen- position of hydrogen in the periodic table. Hydrides-types, preparation, properties and applications. Structure of NaH and BeH_2 . Complex hydrides- LiAlH_4 , NaBH_4 . Preparation and applications. Comparative study of Li and Be with other members of the same group. Comparative study of lattice energy, enthalpy of formation, enthalpy of hydration and solubilities of alkali metal and alkaline earth metal halides, hydroxides and sulphates. Comparison of standard reduction potentials and reducing properties of alkali metals and alkaline earth metals. Complexation tendencies of alkali metals with crown ether, Cryptates.

p-Block Elements: **7Hours**

Comparative study of p-Block elements and their compounds-comparison between Boron and other members of the group.

Boranes: Diborane- Preparation, properties, structure and bonding, chemical evidences for the presence of bridge hydrogen. B_4H_{10} , B_5H_9 , Preparation and structure, Styx number, Wade's rule-Closo, Nido and Arachno boranes. Silicates-types, basic units, structure and applications. Hydrazine and hydroxylamine-structure and reducing property. Hypo phosphorous acid, phosphorous acid, phosphoric acid, orthophosphoric acid, meta phosphoric acid and pyro phosphoric acid- structure. Halogens in positive oxidation state. Inter halogen compounds- ICl , BrF_3 , IF_5 and IF_7 -preparation, properties, structure and uses. Noble gases- Structure and bonding in: Clathrates, XeF_2 , XeF_4 , XeF_6 and XeO_3 .

UNIT III

Reactions Involving Intermediates: 5Hours

Generation, stability and mechanism of reactions- i) carbocations –Dienone-phenol rearrangement ii) carbanions – Perkin reaction, Aldol condensation and Claisen condensation, iii) Free radicals – Sandmeyer's reaction, iv) Nitrenes-Hofmann rearrangement, Curtius rearrangement, v) carbenes- Reimer -Tieman reaction, vi) Arynes- Benzyne mechanism for the conversion of Bromobenzene to aniline. Methods of determination of reaction mechanism-Product analysis, intermediates, isotope effects, kinetic and stereo chemical studies.

Nucleophilic Substitution at Saturated Carbon 2Hours

Mechanism of S_N1 and S_N2 reactions with suitable examples and energy profile diagrams. Stereochemistry and factors affecting S_N1 and S_N2 reactions.

Elimination Reactions 2Hours

Mechanism of $E1$ and $E2$ - explanation with suitable examples, evidences, orientation and stereochemistry. Hoffmann and Saytzeff rules.

Aromatic Electrophilic and Nucleophilic Substitutions 4Hours

Aromatic electrophilic substitution-general pattern of the mechanism with energy profile diagram. Role of σ and π -complexes. Activating and de-activating substituents, Orienting influence, ortho-para ratio. Nucleophilic aromatic substitution reactions- Addition-elimination and Elimination-addition mechanism.

UNIT IV

Industrial Chemistry 13Hours

Fuels: Composition, production and applications of natural gas, water gas, producer gas, LPG and bio gas.

Propellants: characteristics and applications.

Glass: Raw materials, manufacture- tank furnace, steps in manufacture and annealing of glass. Types of glasses: composition and uses of - hard, soft, Pyrex, jena, flint, safety, optical, fibre, coloured and Crooke's glasses.

Cement: Raw materials, manufacture of cement, mechanism of setting of cement. RCC –composition and uses.

Ceramics: Raw materials used in modern ceramics, stages in ceramic making, glazing, applications of porcelain.

Paints: Constituents of paints and their functions with examples. Manufacture of white lead and lithopone.

Refractories: Characteristics, classification with examples and applications,

Abrasives: natural abrasives, synthetic abrasives, characteristics and applications. Silicon carbide and boron nitride- structure and production.

Cane sugar: Outline of production and composition, molasses, its composition.

Paper: Production of wood pulp and preparation of paper.

Chemical fertilizers: Primary nutrients, Different types of fertilizers, importance, production of urea, CAN and superphosphate of lime.

BSCCHP182 CHEMISTRY PRACTICAL-II [3 Hrs/Week (12x3 Hrs)]

- Systematic qualitative analysis of mono and bifunctional organic compounds Determination of melting point/boiling point, preparation of suitable solid derivative and identification compound from literature. Following compounds may be given - Resorcinol, oxalic acid, urea, thiourea, thiophenol, benzoic acid, salicylic acid, phenol, p-cresol, aniline, p-nitroaniline, p-toluidine, benzaldehyde, ethyl methyl ketone,

- acetophenone, benzophenone, chlorobenzene, bromobenzene, nitrobenzene and benzamide. 8 weeks .
- II. Thin Layer Chromatography: Any two of the following. **2 weeks**
 Determination of R_f values and identification of organic compounds,
 a) Separation of green leaf pigments (Spinach leaves may be used),
 b) Preparation and separation of 2,4-dinitrophenylhydrazones of acetone, 2-butanone, hexan-2- and 3-one using toluene and light petroleum (40:60)
 c) Separation of a mixture of dyes using cyclohexane and ethyl acetate (8.5: 1.5)
- III. Paper Chromatography: Ascending and Circular. Any two of the following **2weeks**
 Determination of R_f values and identification of organic compounds,
 a) Separation of a mixture of phenylalanine and glycine, Alanine and aspartic acid, Leucine and glutamic acid. Spray reagent-ninhydrin.
 b) Separation of a mixture of D, L-alanine, glycine, and L-Leucine using n-butanol, acetic acid-water (4:1:5). Spray reagent-ninnydrin,
 c) Separation of monosaccharides-mixture of D-galactose and D- fructose using n-butanol:acetone: water (4:5:1), Spray reagent - aniline hydrogen phthalate.
- IV. Column Chromatography:
 a) Separation of fluorescein and methylene blue.
 b) Separation of leaf pigments from spinach leaves.

Reference

1. Analytical Chemistry-John H. Kennedy, 1986, Saunder's College, New York.
2. Instrumental methods of Chemical analysis. Willard, Merritt, Dean and Skettle, CBS Publishers.
3. Instrumental methods of Chemical analysis by Gurudeep R.Chatval and Sham Anand, 1998, Himalaya Publishing House.
4. A Text Book of Inorganic Chemistry by P.L.Soni.1998, Sultan Chand and Sons.
5. A Text Book of inorganic Chemistry by Puri and Sharma 2000, Shobanlal Nagin Chand.
8. A Text Book of inorganic Chemistry by Gurudeep Raj. Krishna's Educational Publication.
7. A Text Book of inorganic Chemistry by Sathya Prakash, 2001.
8. Concise inorganic Chemistry by J.D.Lee, 1998,Blackwell Science Ltd.
9. Principles of inorganic Chemistry by Puri, Sharma and Kalia.2000, Shobanlal Nagin Chand.
10. Selected Topics in inorganic Chemistry by Madan, Malik,Tuli,2000,S.Chand and Company.
11. Engineering Chemistry-B.K.Sharma,2001,
12. Industrial Chemistry-B.K.Sharma,2001.
13. Organic Reaction mechanism by V.K.Ahluwalia and R.K.Parashar (Narosa Publishing).
14. Organic Chemistry by S.M.Mukherji, S.P.singh and R.K.Kapoor(Narosa)
15. A Text Book of Qualitative analysis- A.I_Vogel, ELBS.

Group II Elective
BSCCHCE-183: Biomolecules and Computer for Chemists
UNIT I

Computers for Chemists

8Hours

Basic structure and functioning of computer with a PC as an illustrative example. Memory, Input/output devices, Secondary storage, Computer languages, Operating systems, Algorithm and Flow chart, programmes and packages, MS-word, Excel, Power Point, Chem Sketch etc. Demonstration, writing and drawing of chemical formulae and structure through chem sketch. Plotting the various graphs such as pressure-volume (PV), pressure-temperature (PT), potentiometric, conductometric and colorimetric plots through Excel.

Buffer Solutions

2Hours

Definition, Types, Buffer Action, Mechanism of Buffer Action, Henderson's Equation (No Derivation), Principles involved in the preparation of buffer solution, Importance of Buffer solution, Numerical Problems.

Solubility Product

2Hours

Expression For K_{sp} , of Sparingly soluble salts of types AB, AB_2 , And A_2B , Relation shipbetween Solubility and solubility product. Common Ion Effect: Applications of Common Ion effect and solubilty product in Inorganic Qualitative analysis.

UNIT II

Chemotherapy

4Hours

Introduction. Classification – antibiotics-Chloramphenicol and Penicillin. Synthesis and Uses. Analgesics – Narcotic analgesics and Non-Narcotic analgesics-Examples and their uses. (Simple Synthesis to be included). Sulphonamides-Preparation of sulphonamides.-Examples and their uses. Antiseptics and disinfectants- Examples and their uses. Hypoglycemic agents – Cancer treatment by Chemotherapy. A brief account of medicinally important compounds. Compounds of aluminum as pharmaceuticals; compounds of phosphorous as pharmaceuticals; Compounds of iron as pharmaceuticals. Examples and uses. (Only specific examples).

Biomolecules:

8Hours

Vitamins: Introduction, classification, Fat soluble vitamins, source of vitamin, vitamin D, Niacin. Water soluble vitamins, pantothenic acid, cyanocobalamin, deficiency diseases.

Photosynthesis of carbohydrate, mechanism of light phase reaction,.

Proteins: Oxytocin and vasopressin, chemical synthesis and biological activity. Antibiotics: Introduction, classification

Lipids: Introduction, occurrence chemical and physical properties, biological functions, Derived lipids, cholesterol and its biological functions

References

1. Computers and their applications to Chemistry – Ramesh Kamari.
2. Computers in Modern Chemistry – A. Kumar.
3. Organic Chemistry of Natural Products,By Gurudeep R.Charwal (Vol-I and II) edited by M.Arora (Himalaya Publishing House).
4. Pharmaceutical Chemistry by Thyagarajan.
5. A Text Book of Physical Chemistry by P.L.Soni, O.P. Dharmarha and U.N.Dash, Sultan Chand and Sons.
6. Physical Chemistry-Madan and Tuli,2001, S.Chand. New Delhi.
7. A Text Book of Advanced Physical Chemistry-Gurudeep Raj 2001, Goel, Meerut

III SEMESTER
BSCCHC231: Chemistry Paper-III
UNIT - I

Thermodynamics: 13 Hours

First Law of Thermodynamics: statement, definition of internal energy and enthalpy. Heat Capacity, heat capacities at constant volume and pressure and their relationship. Joule's Law, Joule - Thomson coefficient and inversion temperature. Bond dissociation energy and its calculation from thermochemical data, temperature dependence of enthalpy. Kirchhoff's equation. Second Law of thermodynamics : Need for the Law, different statements of the Law. Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature. Concept of entropy, entropy as a state function, entropy change for an ideal gas as a function of V & T , entropy as a function of P & T, entropy change in physical changes- fusion, evaporation, sublimation and transition. Entropy change in mixing of ideal gases. Entropy as a criterion of spontaneity and equilibrium. Third Law of thermodynamics: significance, unattainability of absolute zero. Gibbs and Helmholtz functions; Gibbs function(G) and Helmholtz function (A) as thermodynamic quantities, A & G as criteria for thermodynamic equilibrium and spontaneity. Variation of G with P, V and T (Illustrative problems to be worked out).

UNIT - II

Chemistry of d-block elements: 5Hours

Introduction, General characteristics of transitional elements, general electronic configuration, stabilities of oxidation states, complexing ability, colour, magnetic property- expression for magnetic moment –spin only formula μ_s , calculation of μ_s for 3d series elements, Lande's calculation of theoretical magnetic moment. μ_{s+L} , comparison of magnetic moment μ_s and μ_{s+L} with experimental value of μ . Reasons for observed trend, Comparative treatment of 4d, 5d series with their analogues in respect of ionic radii, oxidation states, magnetic behavior and stereochemistry.

Chemistry of f-block elements: 4 Hrs

Introduction, Lanthanide contraction, causes of lanthanide contraction, occurrence, Isolation of lanthanides by ion-exchange method, similarities and comparison between lanthanides and actinides, separation of Neptunium, Plutonium and Americum and Uranium. Problems on calculation of μ_{s+L} for trivalent lanthanide ions,

Nano Chemistry: 4Hours

Introduction, General methods of synthesis, characterization techniques, Scanning Electron Microscopy (SEM)-principle and method of determination, advantages over other microscopes, Fullerenes, Preparation of nanoparticle by chemical method, Application of nanomaterials.

UNIT III

Reactions and reactivity of Phenols: 3Hours

Comparison of acidic properties of phenols with carboxylic acids, alcohols and carbonic acid. Molecular rearrangements- Fries rearrangement, Claisen rearrangement, Synthesis of aryloxy acetic acids.

Structure and reactivity of carbonyl compounds: 7Hours

Structure of carbonyl group, Nucleophilic additions to carbonyl group, relative reactivities of aldehydes and ketones-explanation, Mechanism of reactions involving- Hydride shift-Tischenko reaction, i) C-C bond formation-Bucherer hydantone synthesis, ii) C=C bond formation-Wittig reaction, iii) C=N bond formation-addition of NH_3 derivatives, iv) C-O bond formation-Acetal formation, Michael addition, α , β -unsaturated aldehydes and ketones.

Ethers and Epoxides: 3 Hours

Chemical reactions of ethers-Cleavage and auto-oxidation with examples. Zeisel's method. Synthesis of epoxides, Acid and Base catalyzed Ring opening of epoxides, Orientation of epoxide ring opening with energy profile diagram.

UNIT - IV

Acids and Bases : 2Hours

Lewis concepts of acids and bases. Modern concepts of acids and bases. Usanovich concept, Lux-Flood concept. Hard and Soft Acids and Bases (HSAB): Classification of acids and bases as hard and soft. Pearson's HSAB concept and its applications.

Binary Mixtures: 7Hours

Liquid-liquid mixtures: Ideal liquid mixtures, Raoult's law, Non-ideal system:

Azeotropes: $\text{HCl-H}_2\text{O}$ and ethanol-water systems. Partially miscible liquids: Phenol-water, trimethyl amine and water and nicotine - water systems. Lower and upper consolute temperature. Effect of impurity on consolute temperature. Immiscible liquids, steam distillation. Nernst distribution law- Definition and applications.

Food Technology: 2Hours

Introduction to food chemistry, Fundamentals of food processing, Fundamentals of milk processing, Food analysis, Food packing technology, Food laws and quality assurance.

Corrosion Chemistry: 2Hours

Corrosion - Introduction, Corrosion-an electrochemical phenomenon. Types of corrosion- Galvanic corrosion, Crevice corrosion,, Erosion corrosion, Stress corrosion

BSCCHP232: Chemistry Practical – III [3 Hrs./Week (12x3 Hrs.)]

Semi Micro Qualitative Analysis Of Inorganic Salt Mixture:

Systematic qualitative analysis of mixture of two simple inorganic salts (containing two cations and two anions)

Anions : CO_3^{2-} , HCO_3^- , SO_3^{2-} , S^{2-} , Cl^- , Br^- , I^- , NO_3^- , BO_3^{3-} ,
 PO_4^{3-} , SO_4^{2-} ,

Cations : Pb^{2+} , Cu^{2+} , Bi^{3+} , Cd^{2+} , Co^{3+} , Ni^{2+} , Al^{3+} , Fe^{3+} , Mn^{2+} , Zn^{2+} ,
 Ca^{2+} , Ba^{2+} , Sr^{2+} , Mg^{2+} , Na^+ , K^+ , NH_4^+

Note: First experiment should be exclusively used for explaining the basic principles of qualitative inorganic analysis and demonstration.

Reference Books

1. A Text Book of Inorganic Chemistry by P.L.Soni.1998, Sultan Chand and sons.
2. A Text Book of inorganic Chemistry-Puri and Sharma 2000, Shobanlal Nagin Chand.
3. A Text Book of inorganic Chemistry-Gurudeep Raj.
4. A Text Book of inorganic Chemistry-Sathya Prakash, 2001.
5. Engineering Chemistry-B.K.Sharma,2001,
- 6.Nano materials by A.K.Bandyopadhyay , New Age Publishers NewDelhi.
- 7.Nano Science and Technology By VS Muralidharan and A.Subramania, Ane Books Pvt.Ltd. NewDelhi.
8. An Introduction to Metallic corrosion and its Prevention. By Raj Narayan Oxford and IBH publishing Co , NewDelhi.
9. Qualitative Analysis (A Text Book) -A.I.Vogel, ELBS.
10. Organic Chemistry by S.M.Mukherji, S.P.singh and R.K.Kapoor.
11. Food Science and Technology by Dev Raje.
12. A Text book of Food and Beverage Management by Sudhir Andrews.

Group II Elective

BSCCHCE233: Chemistry and Environment

Unit I

Corrosion and its Prevention

10Hours

Introduction, Causes of different types of corrosion. Corrosion rate,-definition, Factors affecting on corrosion rate. Metallic factor-Purity, Electrode Potential of metal, hydrogen over voltage, nature of corrosion product. Environmental factors-Temperature, pH of the medium, humidity, presence of impurities, electrical conductivity of the medium, velocity of the medium, concentration of the medium.

Prevention of corrosion: Material selection-Metals and alloys, metal purification, non-metallic, Alteration of environment-Changing media, inhibitors, Design-wall thickness, design rules, Coating-Metallic and other inorganic coatings, organic coating.

Water Purification

2Hours

Definition of pure water, sources responsible for contaminating water, water sampling methods, water purification methods.

Unit-II

Green Techniques

12Hours

Introduction, Principles, atom-economy, Prevention of waste, by products, hazardous products/chemicals, water as a solvent for organic reactions, ionic liquids, solidstate-solventless reactions, use of microwaves, careful use of protecting and deprotecting agents, use of catalytic reagents, Phase transfer catalysts and its synthetic applications.

Examples of Green synthesis: Synthesis of adipic acid, catechol, disodium iminodiacetate, Boots synthesis of brufen, Microwave assisted reactions in water-Hofmann elimination, Methyl benzoate to benzoic acid, oxidation of toluene and alcohols

Microwave assisted reactions in organic solvents:-Diels-Alder reaction and decarboxylation reaction, Green synthesis of compostable and widely applicable polylactic acid, plastic from corn.

Limitations of green techniques.

Reference Books:

1. An Introduction to Electrochemistry, By Samuel Glasstone. ACS Publications.
2. Text book of Physical Chemistry By Atkin. Oxford University Press.
3. Text book of Physical Chemistry By Bahl and Bahl. S. Chand Publishers.
4. Text book of Physical Chemistry By Gurudeep Raj. Krishna's Educational Publications.
5. New Trends in Green Chemistry - Ahluwalia V.K and Kidwai M.R, Anamalaya Publishers (2005).
6. Green Chemistry - Theory and Practical, Anastas, P.T and Warner J.K : Oxford University Press (1998).
7. Introduction to Green Chemistry- Matlack, A.S. Marcel Dekker (2001).
8. Introduction to Green Chemistry- Ryan, M.A. & Tinnesand, M., American Chemical Society, Washington (2002).
9. An Introduction to Metallic corrosion and its Prevention by Raj Narayan, Oxford and IBH publishing Co , NewDelhi.

IV SEMESTER
BSCCHC281: Chemistry Paper-IV

UNIT I

Solutions, Dilute Solutions and Colligative Properties **7Hours**

Ideal and non-ideal solutions, Methods of expressing concentrations- Activity and Activity coefficients. Colligative properties; Raoult's law of relative lowering of vapour pressure. Osmosis and laws of Osmotic pressure. Elevation in boiling point and depression in freezing point. Thermodynamic derivation of the relation between elevation of boiling point/depression of freezing point and molecular mass of solute (Illustrative problems to be worked out).

Physical Properties And Molecular Structure **4Hours**

Optical activity, polarization (Clausius-Mosotti equation), orientation of dipoles in an electric field, dipole moment, measurement of dipole moment-temperature method and refractivity method, dipole moment and structure of molecules, magnetic properties-paramagnetism and diamagnetism.

Refractometry: **2Hours**

Introduction, Abbe's Refractometer, applications of Refractometry.

UNIT - II

Coordination Compounds: **5Hours**

Nomenclature, illustration with example including geometrical and optical isomers, bridging ligands. Isomerism in coordination compounds - ionization isomerism, hydrate isomerism, coordinate isomerism, linkage isomerism. Geometrical isomerism and optical isomerism (coordination numbers 4 and 6).

Metal-Ligand Bonding In Transitional Metal Complexes: **8Hours**

Postulates of Valence Bond Theory (VBT), Examples for sp^3 , dsp^2 , dsp^3 , d^2sp^3 and sp^3d^2 hybridization- $[Ni(CO)_4]$, $[Ni(CN)_4]^{2-}$, $[Cu(NH_3)_4]^{2+}$, $[Fe(CO)_5]$, $[Fe(CN)_6]^{3-}$, $[Co(NH_3)_6]^{3+}$ and $[CoF_6]^{3-}$. Explanation for magnetic properties. Limitations of Valence bond theory. Crystal field theory-important concepts of CFT, Crystal field splitting in octahedral, tetrahedral and square planar complexes, Jahn- Teller distortion, and crystal field stabilization energy. Calculation of CFSE, weak and strong field ligands, spectrochemical series, explanation for stability, geometry, magnetic and spectral properties. Factors affecting the crystal field splitting. Limitations of CFT.

UNIT III

Reactive Methylene Compounds: **2Hours**

Keto-enol tautomerism, ethyl acetoacetate and diethyl malonate, Reactions supporting keto and enol forms. Synthetic applications of reactive methylene compounds-Synthesis of alkyl and dialkyl acetic acids, succinic acid, keto acids, α - β unsaturated acids (crotonic acid), 4- Methyl uracil and antipyrine.

Reagents And Their Synthetic Utility: **8Hours**

Different reagents used for the synthesis of organic compounds with reaction mechanism- i) $KMnO_4$ -Oxidation of alkenes to vicinal diols ii) OsO_4 - Synthesis of cis-1,2-diols iii) Per acids-Baeyer-Villiger oxidation iv) Aluminium isopropoxide-Meerwein-Ponndorf-Verley reduction v) $LiAlH_4$ - reduction of carbonyl compounds into alcohols vi) $NaNH_2$ -Chichibabin reaction vii) N-Bromosuccinimide- Allylic bromination of alkenes viii) H_2O_2 – Dakin reaction ix) NH_2-NH_2 (Wolf-Kishner reduction) x) CrO_2Cl_2 (Etard reaction). Explanation with an example for

commonly used synthetic reagents - O_3 (Ozonolysis), Periodic acid(Oxidation of vicinal diols into carbonyl compounds), Lead tetra acetate(Oxidative cleavage of vicinal diamines), CrO_3 (Sarett oxidation), $NaBH_4$ (Reduction of carbonyl compounds into alcohols), Diazomethane(Methylation of carboxylic acids and phenols), Na / ethyl alcohol(Reduction of ester to alcohol by Bouveault-Blanc reduction).

Structure and Reactions of Carboxylic Acids and Their Derivatives:

3Hours

Structure of carboxylic acid and carboxylate ion, Effect of substituents on the acidity of aliphatic and aromatic carboxylic acids (ortho effect). Reactions of carboxylic acids, with mechanism-i) Homologation-Arndt-Eistert reaction ii) Degradation to alkyl halides-Hunsdiecker reaction iii) Conversion to primary amines-Curtius reaction iv) Conversion to haloacids-HVZ reaction Derivatives of carboxylic acids- acid chlorides, amides esters, anhydrides-preparation. Reactions of acid derivatives-i) Conversion to aldehydes-Rosenmund's reduction.

UNIT IV

Chemical Equilibrium:

4Hours

Derivation of relationship between equilibrium constant and free energy $\Delta G^{\circ} = -RT \ln K_p$. Thermodynamic derivation of law of mass action. Le Chatelier's principle-statement and applications. van't Hoff's reaction Isotherm and reaction isochore (van't Hoff equation) (Illustrative problems to be worked out).

Phase Equilibrium:

7Hours

Phase rule-Statement (mathematical expression) and meaning of the terms. Explanation for the terms phase, component and degrees of freedom with suitable examples for each. Derivation of phase rule from thermodynamic consideration. Explanation of phase equilibria of one component system (water and Sulphur system) using phase diagram. Two component system-classification with examples, simple eutectic system (lead-silver system)- phase diagram and explanation, desilverisation of lead (Pattinson's Process). Solid solutions-compound formation with congruent melting point (Mg-Zn system) - phase diagram and explanation. Compound formation with incongruent melting point (NaCl + water system)-phase diagram and explanation. Freezing mixtures (acetone-dry ice). Solid solution formation.

Radiation and Nuclear Chemistry:

2Hours

Radiolysis of water (using γ rays), radiation dosimetry, dosimeter, applications in organic and inorganic reactions. Application of radioisotopes in the study of organic reaction mechanism, medicine and soil fertility. Industrial applications.

BSCCHP282 Chemistry Practical- IV [3 Hrs / week (12 x 3 Hrs.)]

Determination or study of the following.

1. Specific reaction rate for the acid catalyzed hydrolysis of methyl acetate at room temperature using 0.5N HCl or 0.5N H_2SO_4 .
2. Effect of acid strength on the hydrolysis of an ester.
3. Comparison of the catalytic strengths of HCl and H_2SO_4 by studying the kinetics of hydrolysis of methyl acetate.
4. Rate of decomposition of iodide by H_2O_2 .

5. Distribution of iodine between water and CCl_4 .
6. Distribution of benzoic acid between benzene and water.
7. Preparation of arsenious sulphide sol and comparison of the precipitating power of mono-, bi- and trivalent anions.
8. Density and viscosity of the given liquid (using specific gravity bottle and viscometer.)
9. Percentage composition of a given mixture of glycerol and water by viscometry.
10. Density and surface tension of a liquid.
11. Composition of binary liquid mixture (Alcohol & toluene) by Refractometry.
12. Percentage of NaCl present in phenol-water system.
13. Molecular weight of a non-volatile solute by Walker - Lumsden method.
14. Critical solution temperature of Phenol-water system.

Reference Books

1. Selected Topics in inorganic Chemistry-Madan, Malik,Tuli,2000,S.Chand and Company.
2. A Text Book of inorganic Chemistry-A.K.De, 2001, New Age international.
3. Engineering Chemistry-B.K.Sharma,2001,
4. A Text Book of Quantitative analysis- A.I_Vogel, ELBS.
5. A Text Book of Inorganic Chemistry-P.L.Soni.1998, Sultan Chand and Sons.
6. A Text Book of inorganic Chemistry-Puri and Sharma 2000, Shobanlal Nagin Chand.
7. A Text Book of inorganic Chemistry-Gurudeep Raj.
8. A Text Book of inorganic Chemistry-Sathya Prakash, 2001.
9. Organic Chemistry-Paula Y. Bruise. 3rd edn,_Pearson Education Publishers.
10. Physical Chemistry-Madan and Tuli,2001, S.Chand. NEW DELHI.
11. A Text Book of Advanced Physical Chemistry-Gurudeep Raj 2001, Goel, Meerut.
12. A Text Book of Physical Chemistry- B.D. Khosla, 2000, R. Chand.
- 13.Organic Reaction mechanism by V.K.Ahluwalia and R.K.Parashar
- 14.Organic Chemistry by S.M.Mukherji, S.P.singh and R.K.Kapoor.
- 15.Concise Co-ordination Chemistry by R.Gopalan and V.Ramalingam, Vikas Publishing house Pvt.limited.Noida.

Group II Open Elective

BSCCHOE283 : Food Chemistry and Chemistry in Daily Life

UNIT I

Food Chemistry

5hours

Food as source of energy and structural material. Components of food – Carbohydrates, Proteins, Oils and Fats. Micronutrients-Vitamins, minerals. Chemical substances used in food preparation - water, common salt, baking powder, vinegar. Food Processing. Food additives, preservatives and flavours. Explanation with examples for the preservation of food by the use of inhibitors, drying, salting, canning, pickling, smoking, packing and refrigeration. Food safety. Soft drinks-Components. Effects on health.

Food Adulteration**2Hours**

Definition, common harmful effects, detection of adulteration, Prevention, Food adulteration act, artificial ripening of fruits - explanation with examples'.

Chemistry of household materials**5Hours**

Cleansing agents: Chemical composition of Soaps, detergents, dish washers, drain cleaners, bleaching powder, Tooth paste and shampoo. Stain removers – Explanation with some common examples.

Domestic items: Safety matches, Wax candles, shoe polish and mosquito coils,- their chemical composition.

Cosmetics: Talcum powder, nail polish, thinners, skin care, hair care, Lipsticks, sun protection lotions and creams, eye shadow and eyebrow pencils, antiperspirants, perfumes and deodorants-explanation with examples.

UNIT II**Chemistry for our future****12Hours**

Alternative sources of energy: Need for the search of renewable sources of energy.

Solar Energy: Basic properties of solar energy. Applications of solar energy. Transformation of solar energy. Solar heat collectors. Solar photovoltaic collectors. Applications of solar collectors. Examples. Solar power plant.

Wind Energy: Basic properties of wind energy. Applications of wind energy. Transformation of wind energy. Wind turbines. Operative characteristics of wind turbines. Wind power plant. Utilization of wind power. Examples. Trends in wind energy utilization.

Hydro power: Basic properties water energy. Transformation of water energy. Hydro power plant. Utilisation of hydro power. Examples. Trends in hydro power utilization.

Hydrogen energy: Production and applications.

Ocean energy- Principles of ocean thermal energy, conversion system. Principles of wave and tidal energy conversion.

Transformation of biomass energy. Applications of biomass.

Reference Books:

10. Food: The Chemistry of its components -Tom Coultate, Kindle Edition.
11. Food Science and Technology-Geoffrey Campbelt-Platt,Wiley Blackwell, Kindle Edition.
12. Food chemistry by H.K.Chopra and P.S.Panesar (Narosa Publishing).
13. Chemistry at Home: Exploring the ingredients in everyday products- John Emsley, Royal Society of Chemistry (2015).
14. Chemistry in daily life - Kirpal Singh, Third Edition, Eastern Academy Education, PHI Learning Pvt. Ltd, New Delhi(2012).
15. Chemistry in everyday life-Shardendu Kislaya, Discovery Publishing House Pvt.Ltd(2011).
16. Renewable energy sources and emerging technologies-D.P.Kothari, K.C.Singal and Rakesh Ranjan, Eastern Economy Edition.

17. Solar energy: fundamentals and applications- H.P.Garg and J.Prakash, Mc Graw Hill, First Revised Edition.
18. Biomass regenerable energy-D.O.Hall and R.P.Overend, Wiley-Blackwel(1987).
19. Introduction to wind turbine aerodynamics – Alois Peter Schaffarczyk, Springer(2014).
20. Hydrogen and fuel cells: Fundamentals, technologies and applications-Detlef Stolten, Wiley-Vest(2010).

V Semester
BSCCHC331: Chemistry Paper-V

Unit I

Electrochemistry:

4Hours

Strong and Weak electrolytes, Specific conductance, Equivalent conductance and its determination, Debye-Huckel theory, Debye-Huckel-Onsager's equation for strong electrolytes (no derivation). Transport number, definition, determination of transport number by Hittorf's method using attackable and unattackable electrodes and Moving boundary method. Kohlrausch's law and its applications,

Photochemistry :

6Hours

Interaction of radiation with matter, difference between thermal and photochemical processes. primary and secondary processes of a photochemical reaction, Laws of photochemistry: Grotthuss - Draper law, Stark - Einstein law, (only statement) Jablonski diagram depicting various processes occurring in the excited state, qualitative description of fluorescence, phosphorescence, non-radiative processes (internal conversion, intersystem crossing). Quantum yield-definition, reasons for low and high quantum yield. Explanation for low and high quantum yield reactions taking combination of H₂ and Br₂ and combination of H₂ and Cl₂ as examples. Photosensitized reactions-energy transfer processes definition of photosensitization. (e.g.: Photosynthesis in plants, dissociation of H₂, Isomerization of 2-butene and butadiene).

Unit II

Application of Metal Complexes and Complexation:

2Hours

Applications of complexes and complex formation in metallurgy-Ag, Au, Al, Ni extractions, Volumetric analysis- complexometry, masking, demasking techniques with example, Qualitative analysis-test for ferrous and ferric ions, nitrate and ammonium ions, Gravimetric analysis-Precipitation of nickel, magnesium and aluminum ions.

Thermodynamic and Kinetic Aspects of Metal Complexes

3Hours

A brief outline of thermodynamic stability of metal complexes. Stepwise formation and overall formation constants and factors affecting the stability of complexes. Substitution reactions of square planar complexes, Trans effect, theories and applications of Trans effect.

Magnetic Properties of Transition Metal Complexes:

3Hours

Origin of magnetism, terms used in Magnetochemistry- Magnetic induction, Magnetic flux density, Magnetic moment and Magnetic susceptibility, Magnetic permeability. Magnetic behavior of substances-Types of magnetic behavior, Methods of determining magnetic susceptibility-Gouy's method. Temperature dependence of magnetic properties, Curie temperature, Neel temperature, Application of magnetic moment data of 3d-metal complexes.

Supramolecular Chemistry

2Hours

Introduction – Definition, basics of Supra molecular chemistry, Classification of Supra molecules, Host and guest compounds, Driving forces for the formation of supramolecular structures , Applications

Unit III

Organic Compounds of Nitrogen

3Hours

Nitroarenes- reduction in acidic, neutral and alkaline media. Mechanism of nucleophilic substitution in nitroarenes. Amines-Separation of mixture of primary, secondary and tertiary amines (Hinsberg and Hofmann's method). Mechanism of electrophilic aromatic substitution in aryl amines.

Stereochemistry of Organic Compounds

7Hours

Configurational isomerism-optical, geometrical and conformational. Optical isomerism-elements of symmetry, molecular chirality, stereogenic centre-chiral and achiral molecules with two stereogenic centres-Eg., Lactic acid and Tartaric acid. Enantiomers-properties. Resolution of enantiomers.

Diastereomers-definition & examples, threo and erythro diastereomers, meso compounds-definition and examples. Inversion (of sugars) and racemization. Relative and absolute configuration, sequence rules, D&L, R& S systems of nomenclature. Geometric isomerism:-determination of configuration of geometric isomers. E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds. Conformational isomerism-conformational analysis of ethane and 1,2-dichloroethane. Conformations of cyclohexane-Newman projection. Differences between configuration and conformation.

Unit IV

Rotational Spectroscopy

4Hours

Derivation of equation for moment of inertia of diatomic molecule, Diatomic molecule as rigid rotor ; derivation of equation for moment of Inertia of diatomic molecule, energy levels of a rigid rotor, selection rules, spectral intensity, determination of bond length, qualitative description of non-rigid rotor, isotope effect.

Vibrational Spectroscopy:

6Hours

Molecular vibrations, vibrational degrees of freedom, Hooke's law, Energy levels of a simple harmonic oscillator, selection rules, Instrumentation and measurement of IR spectrum intensity and position of IR bands, determination of force constant and qualitative relation of force constant and bond energies, effect of anharmonic motion, Fingerprint region and functional group region. Characteristic absorptions of various functional groups and interpretation IR spectra of simple organic compounds.

V Semester
BSCCHC332 : Chemistry Paper- VI

Unit I

Elementary Quantum Mechanics **8Hours**

Black-body radiation, Planck's radiation law, photoelectric effect, Compton effect. De Broglie hypothesis, Heisenberg's uncertainty principle, Sinusoidal wave equation, Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box. Setting up of Schrodinger wave equation for H-atom (no separation of variables or solution), quantum numbers and their importance.

Raman Spectroscopy **2Hours**

Classical and Quantum theory of Raman effect. Concept of polarisability. Rotational and Vibrational Raman Spectra. Selection Rules.

UNIT II

Electronic Spectra of Transition Metal Complexes **5Hours**

Introduction, Russel –Saunders's coupling, microstates, Spectroscopic ground state for d^n system, Terms generated by ligands, Types of electronic spectra, Selection rules for d-d transitions, Relaxation of selection rules, Spectrochemical series. Orgel-energy level diagram for d^1 and d^9 systems, discussion of the electronic spectra of $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$ and $[\text{Cu}(\text{H}_2\text{O})_6]^{+2}$ complex ions.

Organometallic Compounds **5Hours**

Definition, nomenclature and classification of organometallic compounds. Preparation, properties, bonding and applications of alkyls and aryls of Li and Hg, mononuclear carbonyls and the nature of bonding in metal carbonyls, evidences in support of back bonding, Industrial applications of organometallic compounds- Hydrogenation of alkenes-Wilkinson's catalyst, Fischer Tropsch synthesis.

UNIT III

Heterocyclic Chemistry **8Hours**

Classification and nomenclature, Molecular orbital pictures and explanation for the aromatic characteristics of pyrrole, furan, thiophene, pyridine, pyrazole, oxazole and thiazole. Comparison of aromaticity of these compounds. General methods of synthesis (any two) and reactions of these compounds, mechanism of electrophilic substitution in furan. Mechanism of electrophilic and nucleophilic substitution in pyridine, comparison of basicity of pyridine, piperidine and pyrrole, condensed five and six membered heterocycles- explanation with examples. Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fischer- Indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis, Mechanism of electrophilic substitution reactions of indole and quinoline.

Nucleic Acids **2Hours**

Components of Nucleic acids: Adenine, guanine, thymine and Cytosine (Structure only), other components of nucleic acids, Nucleosides and nucleotides (nomenclature), Structure of polynucleotides; Structure of DNA (Watson-Crick model) and RNA(types of RNA), Genetic Code, Biological roles of DNA and RNA: Replication, Transcription and Translation.

UNIT IV

Flame photometry **2Hours**

General principles, Instrumentation, Interference and applications

Thermo Analytical Methods **2Hours**

Principles and applications (TG, DTA & DTG)

Bioinorganic chemistry **3Hours**

Essential and trace elements in biological processes, Biological role of metals - Ca^{2+} , Mg^{2+} , Na^+ , K^+ , Fe^{2+} , Cu^{2+} , Zn^{2+} . Effect of excess intake of metals, metalloporphyrins with reference to haemoglobin and myoglobin. chlorophyll.

Symmetry and Point Groups **3Hours**

Symmetry elements and associated symmetry operations. Types of symmetry elements-axis of symmetry, plane of symmetry, centre of symmetry, identity, rotation reflection axes. Classification of molecules based on symmetry elements- Schoenflies notation, taking the examples of H_2O , NH_3 , BF_3 , trans N_2F_2 and HCl . Flow chart for assigning point group.

BSC CHP 333 : Chemistry Practical –V. [4Hours / Week (12 x 4 Hours.)]

1. Inorganic gravimetric Experiments :
 - a) Estimation of barium as barium sulphate in barium chloride solution.
 - b) Estimation of copper as cuprous thiocyanate in copper sulphate solution.
 - c) Estimation of Ni as nickel dimethyl glyoximate in nickel ammonium sulphate solution.
 - d) Estimation of iron as ferric oxide in ferrous ammonium sulphate solution.
 - e) Estimation of chloride/silver as AgCl in NaCl /silver nitrate solution.
 - f) Estimation of magnesium as oxinate in magnesium sulphate solution.
2. Solvent Extraction : Separation and estimation of Mg(II) and Fe(II) ions.
3. Colorimetry : Verification of Beer-Lambert Law, Job's and Mole-ratio methods.
4. Food Adulteration : Determination of adulteration in food stuffs.
5. Effluent analysis : Analysis of effluent water.
6. Steam Distillation : Steam distillation of Naphthalene from its suspension in water / clove oil from cloves / Separation of o- and p-nitrophenols.
7. Resolution of racemic mixture of (\pm) mandelic acid.
8. Stereo chemical study of organic compounds via models :
 - a) R and S configuration of optical isomers.
 - b) E and Z configuration geometrical Isomers.
 - c) conformational analysis of cyclohexanes and substituted cyclohexane.

Note: First experiment should be exclusively used for explaining the principle of gravimetric analysis and demonstration.

Reference Books

1. Basic concepts of Analytical Chemistry - S.M.Khopkar, II Edn. 1993, New Age International Publishers.
2. Instrumental methods of Chemical analysis- B.K. Sharma, 199. Goel Publishing House.
3. Instrumental methods of Chemical analysis -Gurudeep R.Chatwal and Sham Anand, 1998, Himalaya Publishing House.
4. instrumental methods of Chemical analysis. Willard, Merritt, Dean and Skettle, CBS Publishers.
5. A Text Book of inorganic Chemistry-Gurudeep Raj.
6. A Text Book of inorganic Chemistry-Sathya Prakash, 2001.
7. Concise inorganic Chemistry-J.D.Lee, 1998,Blackwell Science Ltd.
8. Principles of inorganic Chemistry-Puri, Sharma and Kalia.2000, Shobanlal Nagin Chand.
9. Selected Topics in inorganic Chemistry-Madan, Malik,Tuli,2000,S.Chand and Company.
- 10.A Text Book of inorganic Chemistry-A.K.De, 2001, New Age international.
12. A Text Book of Quantitative analysis- A.I_Vogel, ELBS,
13. Inorganic Polymers-G.R.Chatwal, 1993, Himalaya Publishing House.
14. Theoretical principles of Inorganic Chemistry-Manku, 2001, Tata Mc Graw Hills.
15. A Text Book of inorganic Chemistry-Cotton and Wilkinson. 1992, Wiley — Interscience.
16. A Text Book of inorganic Chemistry- Emeleus and Anderson. 1992, New Age Publications.
17. Organic Chemistry-Paula Y. Bruise. 3rd edn,_Pearson Education Publishers.
18. Agricultural Chemistry -B.A. Yagodin, 1976. Mir Publishers (Moscow).
19. Physical Chemistry-Madan and Tuli,2001, S.Chand. New Delhi.
20. A Text Book of Advanced Physical Chemistry-Gurudeep Raj 2001, Goel, Meerut.
- 21 A Text Book of Physical Chemistry- B.D. Khosla, 2000, R. Chand.
22. Fundamentals of molecular spectroscopy-C.Banwell and E.M Mc Cash,1982,Himalaya Publishing.
- 23 Physical Chemistry-Colin N.Banwell, 1998, Himalaya Publishing.
- 24- Physical Chemistry—Glasstone, 1982 ELBS.
25. A Text Book of Physical Chemistry-P.L.Soni , O.P.Dharmarha and U.N.Dash, Sultan Chand and Sons.
26. Organic Spectroscopy-William Kemp, ELBS.
27. Elementary Organic Spectroscopy-Y.R.Sharma, New Age.
28. Systematic experiments in chemistry- Arun Sethi, New Age Publishers.
29. Organic spectroscopy by S.K,Dewan_
30. Organic Reaction mechanism by V.K.Ahluwalia and R.K.Parashar
31. Organic Chemistry by S.M.Mukherji, S.P.singh and R.K.Kapoor.
- 32.Introduction to Supramolecular chemistry by Asim K Das and Mahua Das.
- 33.Bioorganic , bioinorganic and Supramolecular Chemistry by PS Kalsi
- 34.Advanced Physical Chemistry by Gurudeep Raj (Krishna Prakashan)
39. Bio-Inorganic Chemistry by K. Hussain Reddy , New Age Publishers,New Delhi.
40. Group Theory and Symmetry in Chemistry by Gurudeep Raj , Ajay

Bhagi and Vinod Jain, 4 th edition.

41. Chemical applications of group theory (third edition) by F A Cotton.

42. Advanced inorganic chemistry Vol II by S P Banerjee.

43. Group theory and its applications in Chemistry (second edition) by Salahuddeen Kunju and G. Krishnan.

43. Essentials of Nuclear Chemistry by H.J. Arnikar, Wiley Eastern.

44. Organometallic chemistry by R.C. Mehrotra and A. Singh, New age International, New Delhi.

45. Heterocyclic Chemistry by Raj K. Bansal, New Age International, New Delhi.

46. Medicinal Chemistry by G.R. Chatwal Himalaya Publishing House.

VI Semester

BSCCHC381: Chemistry Paper- VII

Unit I

Electrochemistry II :

8Hours

Application of conductivity measurements: determination of degree of dissociation, determination of K_a of acids, determination of solubility product of a sparingly soluble salt and conductometric titrations. Reference electrodes : Calomel electrode quinhydrone electrode and Ag/AgCl electrode. EMF of a cell and its measurements. Computation of cell EMF. Relation between G and K for a cell reaction, decomposition potential and its applications and hydrogen overvoltage. Concentration cell with and without transport, Liquid Junction potential, Application of concentration cells- determination of valency of ions and solubility product, potentiometric titrations. Determination of pH using hydrogen, quinhydrone and glass electrodes by potentiometric methods.

Fuel Cells

2Hours

Importance, Working of Hydrogen Oxygen fuel cell and Methanol-oxygen fuel cell

Unit II

Inorganic Polymers :

4Hours

Preparation, properties, structure and applications of Silicones, Fluorocarbons and Phosphonitrilic halides. Production and structural features of borazine, boron nitride, sulphur nitride $(SN)_x$ and silicon carbide.

Synthetic Polymers :

4Hours

Introduction, general classes of synthetic polymers-Addition and condensation with examples, Types of polymerization (i) Free radical polymerization (ii) Cationic polymerization and (iii) Anionic polymerization of vinyl polymers with one example each, Zeigler-Natta polymerization.

Condensation polymers-Phenol formaldehyde resins- Bakelite, urea-formaldehyde resins, Epoxy resins and polyurethanes-preparation and applications. Natural rubber-composition. vulcanization, Synthetic rubbers: Buna-S and SBR-preparation and applications, advantages of synthetic rubbers over natural rubbers.

Composites :

2Hours

Introduction, role of matrix in composites, types of matrix, different matrix materials, reinforcement, classification of composites and applications of composites in industry.

Unit III

Alkaloids: **3Hours**
Classification with examples—Pyridine, piperidine, Quinoline, Isoquinoline and indole alkaloids. General properties—formation of salts and exhaustive methylation, physical properties and physiological activity. Structural elucidation of nicotine including synthesis. Structural formulae of atropine and cocaine.

Terpenes: **3Hours**
Classification with examples, Isolation from plant sources. Structural elucidation of citral including synthesis. Structural formulae of geraniol, menthol, α -pinene and camphor, Industrial synthesis of camphor.

Pesticides, fungicides and herbicides: **2Hours**
Introduction to the Structure and properties of Pesticides: i) organochlorine compounds-DDT, BHC-, ii) Organophosphorus compounds-Malathion, Parathion, Endosulphan iii) others-Pyrethrin, Aleprin, Baygon. Herbicides: 2,4-dichlorophenoxy acetic acid. Fungicides: Bordeaux mixture, Dithiocarbamate.

Green Chemistry: **2Hours**
Green Chemistry for sustainable development. Designing a Green Synthesis, Prevention of Waste by products, concept of atom economy, Prevention/minimization of hazardous/ toxic products reducing toxicity. Green solvents—examples.

Unit IV

Mass spectrometry : **4Hours**
Principle and instrumentation of mass spectrometer. Applications in the determination of molecular mass and isotopic abundance. Nitrogen rule, even electron rule, McLafferty rearrangement. Differentiation between 2-methylbutanal and 3-methylbutanal by McLafferty rearrangement

Petroleum and Petrochemicals: **3Hours**
Composition of Petroleum, Petroleum refining, Fractional distillation-fractions and their uses. Cracking of Petroleum-Thermal and catalytic. Fixed bed catalytic cracking. Synthetic petrol and its production by Bergius process. Knocking, Octane number and Cetane number. Catalytic and thermal reforming. Important petrochemicals and their applications.

Polymers: **3Hours**
Conducting polymers: Introduction, definition and examples-polyaniline, polyacetylene. Mechanism of conduction. Qualitative treatment of doping, Properties- elasticity with high electrical conductivities, Engineering and biological applications.

Biodegradable polymers: Introduction, Structure and Properties, Mechanism of breakdown, Applications and uses

VI Semester

BSCCHC382: Chemistry Paper- VIII

UNIT I

Colorimetry and Spectrophotometry **3Hours**
Introduction, theory of colorimetry and spectrophotometry. Beer-Lambert's law. Instrumentation and applications of colorimetry and spectrophotometry.

Ultraviolet (UV) absorption spectroscopy **7Hours**

Absorption laws -Beer-Lambert law, Concept of molar absorptivity, energy level, types of electronic excitations, Frank-Condon principle(explanation about red shift and blue shift), presentation and analysis of UV spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts. UV spectra of conjugated dienes dienones and α - β unsaturated carbonyl compounds. Woodward Fieser's rules (problems to be discussed).

UNIT II

Nuclear magnetic resonance (NMR) Spectroscopy **8Hours**

Introduction, origin of spectra, instrumentation of PMR spectrometer, solvents used, scales, nuclear shielding and deshielding, number of signals obtained from the sample, position of signals and chemical shift and molecular structure, spin-spin splitting, spin notation and coupling constants, area of signals, interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol, acetaldehyde, 1,1,2-tribromo ethane and ethyl acetate.

Photoelectron Spectroscopy **2Hours**

Basic principles, valence and core binding energies, shifts in energies due to chemical forces, photoelectron spectra of simple molecules.

UNIT III

Carbohydrates **3Hours**

Monosaccharides: interconversions of glucose and fructose, chain lengthening of aldoses (Kiliani-Fischer method), Chain shortening (Ruff degradation) Conversion of glucose and mannose–epimerisation, Mechanism of osazone formation-Amadori rearrangement, Formation of glycosides, ethers (methyl), esters (acetates). Configuration of glucose and fructose-deduction, Determination of ring size of monosaccharides (methylation and periodic acid method), Elucidation of cyclic structure of D(+) glucose, Mechanism of muta rotation.

Amino Acids, Proteins and Peptides **3Hours**

Classification based on functional group, Essential and nonessential amino acids, structure and stereochemistry of amino acids- explanation, Acid–base behaviour, isoelectric point and electrophoresis- explanation, Preparation of α amino acids from α halogenated acids, Strecker synthesis and Gabriel synthesis. Reactions due to -COOH and -NH₂ groups, Action of heat, structure and nomenclature of di-, tri- and polypeptides, classification of proteins based on chemical composition and molecular shape. Peptide structure determination – end group analysis, selective hydrolysis of peptides, classical peptide synthesis, solid phase peptide synthesis, levels of protein structure- primary, secondary, tertiary and quaternary structures, Denaturation of proteins.

Vitamins and Hormones **2Hours**

Definition, Classification with example and their importance. Synthesis of vitamin C from D-glucose. Synthesis of vitamin A from β -ionone. Synthesis of Adrenaline from catechol . Synthesis of thyroxine from p-nitroanilin

Retrosynthesis **2Hours**

Retrosynthesis: Introduction, general terms, synthon, synthetic equivalent, target molecule, general guidelines for disconnection. Retro analysis and synthesis of benzocaine, 4-methoxy acetophenone, saccharin.

Unit IV

Lipids

5Hours

Introduction, Classification. Fatty acids—definition, classification as saturated and unsaturated with examples and structure (lauric, myristic, palmitic, stearic, oleic, linoleic and linolenic acids). Essential fatty acids – definition with examples Triglycerides—Structure of simple and mixed glycerides. Biological importance of triglycerides. Phosphoglycerides – general structure of 3-Sn–phosphatidic acid, lipid bilayer (as in cell membrane), micelles, liposomes and its applications, structure and biological importance of lecithin, cephalin, phosphatidylserine, phosphatidylinositol. Cholesterol – definition, types (HDL, LDL and VLDL) Sphingolipids—structure and biological significance of ceramide.

Drugs and Chemotherapeutic agents:

2 Hours

Classification with examples. Synthesis of antipyrine, Chloramine-T, sulphathiazole and sulphanilamide.

Organo Sulphur Compounds:

3Hours

Thiols(Mercaptans): Methods of preparation (any two). Reactions-action of sodium, formation of salts, formation of thiol esters and oxidation. Uses of mercaptans.

Thioethers: Methods of preparation(any two). Reactions-Addition of halogens and alkyl halides, Oxidation and hydrolysis. Structure and uses of sulphonal.

Sulphonic acids: Methods of preparation(any two). Reactions of benzene sulphonic acid- i)involving H atom of –SO₃H group ii)involving -OH group of –SO₂OH group iii)involving –SO₃H group iv)involving benzene ring. (One example each).

BSCCHP383 : Chemistry Practical- VI [4 Hrs / week (12 x 4 Hrs)]

Organic Preparations :(Students should be taught how to select a solvent for crystallization, and how crystallization should be carried out)

1. Preparation of acetanilide from aniline / Benzoylation of aniline.
2. Preparation of p-bromoacetanilide
3. Nitration of acetanilide to p-nitroacetanilide and hydrolysis to p-nitroaniline.
4. Preparation of iodoform from ethanol
5. Preparation of m-dinitrobenzene
6. Preparation of adipic acid from cyclohexanol.
7. Preparation of benzoic acid from toluene/benzaldehyde
8. Preparation of tribromoaniline from aniline and conversion to tribromo benzene.

Instrumental Methods

9. To determine the strength of the given acid mixture (acetic acid + hydrochloric acid) conductometrically using standard alkali solution.
10. To determine the dissociation constant of a weak acid by potentiometric method.
11. To determine equivalent conductance of sodium chloride by conductometric method.
12. To determine the ionization constant of a weak acid conductometrically.
13. Potentiometric titration of ferrous ammonium sulphate using potassium dichromate as titrant and calculation of the red-ox potential of Fe³⁺ / Fe²⁺ system on the hydrogen scale.
14. To study the rate of inversion of cane sugar.

15. To determine the concentration of cupric ions present in a solution using a colorimeter.

Preparation of Complexes:

16. Preparation of sodium trisoxalatoferate (III), $\text{Na}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$

17. Preparation of tetraammine copper (II) sulphate, $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4$

18. Preparation of hexaamminecobalt (III) chloride, $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$.

Note: Principles of physical chemistry experiments, organic preparation and complex preparation are to be discussed in the laboratory.

Reference Books:

1. Instrumental methods of Chemical analysis -Gurudeep R.Chatval and Sham Anand, 1998, Himalaya Publishing House.

2. Analytical Chemistry-John H. Kennedy,1986, Saunder's College, New York.

3. Instrumental methods of Chemical analysis. Willard, Merritt, Dean and Skettle, CBS Publishers.

4. A Text Book of Inorganic Chemistry-P.L.Soni.1998, Sultan Chand and Sons.

5. A Text Book of inorganic Chemistry-Puri and Sharma 2000, Shobanlal Nagin Chand.

6. A Text Book of inorganic Chemistry-Gurudeep Raj.

7. A Text Book of inorganic Chemistry-Sathya Prakash, 2001.

8. Concise inorganic Chemistry-J.D.Lee, 1998,Blackwell Science Ltd.

9. Principles of inorganic Chemistry-Puri, Sharma and Kalia.2000, Shobanlal Nagin Chand.

10. Selected Topics in inorganic Chemistry-Madan, Malik,Tuli,2000, S.Chand and Company.

11. A Text Book of inorganic Chemistry-A.K.De, 2001, New Age international.

12. Industrial Chemistry-B.K.Sharma,2001.

14. A Text Book of Quantitative analysis- A.I_Vogel, ELBS,

15. Inorganic Polymers-G.R.Chatwal, 1993, Himalaya Publishing House.

16. Theoretical principles of Inorganic Chemistry-Manku, 2001, Tata Mc Graw Hills.

17. A Text Book of inorganic Chemistry-Cotton and Wilkinson. 1992, Wiley — Interscience.

18 A Text Book of inorganic Chemistry- Emeleus and Anderson. 1992, New Age Publications.

19. Organic Chemistry-Paula Y. Bruise. 3rd edn, _Pearson Education Publishers.

20. Agricultural Chemistry -B.A. Yagodin, 1976. Mir Publishers (Moscow).

21. Physical Chemistry-Madan and Tuli,2001, S.Chand. NEW DELHI.

22. A Text Book of Advanced Physical Chemistry-Gurudeep Raj 2001, Goel, Meerut.

23. Fundamentals of molecular spectroscopy-C.Banwell and E.M Mc Cash,1982,Himalaya Publishing.

24- Physical Chemistry—Glasstone, 1982 ELBS.

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26. Organic Spectroscopy-William Kemp, ELBS.

27 Elementary Organic Spectroscopy-Y.R.Sharma, New Age.

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29. Organic spectroscopy by S.K,Dewan_
- 30 Organic Reaction mechanism by V.K.Ahluwalia and R.K.Parashar
31. Organic Chemistry by S.M.Mukherji, S.P.singh and R.K.Kapoor.
32. Advanced Physical Chemistry by Gurudeep Raj (Krishna Prakashan)
33. Fuel Cells: Chemical and Electrochemical energy systems by R Narayanan, B Vishvanathan. (University Press India Pvt Ltd.).
- 34.Polymer Composite By M.C.Gupta and A.P.Gupta New Age International Limited , Publishers NewDelhi
- 35.Green chemistry by V.K.Ahluwalia ,Ane Books ,India.2006.
36. A Hand book of Sustainable polymers by Vijay Kumar Thakur and Manju Kumari Thakur.
37. Degradable polymers, Principles and Applications by Gerald Scott. Kluwer Academic Publications.
38. Hand book of Biopolymers edited by Shakeel Ahmed, Suvadhan Kanchi, Gopalkrishnan Kumar.
38. Polymer Science - A Text Book by V.K.Ahluwalia and Anuradha ,Ane Books India , NewDelhi.

MANGLORE UNIVERSITY

Scheme of Practical Examinations and Valuation Procedures for B.Sc. Chemistry Practicals

BSc – I Semester BSCCHP132: Chemistry Practical – I

Duration: 3Hrs

Max. Marks: 40 (Practical-30; class record- 10)

The practical examination shall consist of the following:

Q.1.Exercise set for procedure writing

10marks:

Outline of the procedure including calculations is to be written within the first 15 minutes. Any one of the exercises may be given for this purpose, irrespective of whether a candidate has carried out experiment or not.

1. Estimation of manganese in pyrolusite by volumetric method.
2. Estimation of glucose using iodine and sodium thiosulphate.
3. Estimation of vitamin-C.
4. Determination of acetic acid in Vinegar using NaOH.
5. Determination of alkali content in antacid tablet using HCl

Q.2. Exercise to be set for actual estimation.

30 marks:

Any one of the following exercises is to be set for actual estimation. Examiners shall provide the candidates a detailed procedure for the exercise set:

1. Preparation of standard decinormal solution of sodium carbonate and standardization of hydrochloric acid and estimation of sodium hydroxide in solution.
2. Preparation of standard decinormal solution of potassium biphthalate and standardization of sodium hydroxide solution and estimation of hydrochloric acid in solution.
3. Preparation of standard decinormal solution oxalic acid and standardization of potassium permanganate solution and estimation of Mohr's salt in solution.
4. Preparation of standard decinormal solution of ferrous ammonium sulphate (Mohr's salt) and standardization of potassium dichromate solution and estimation of ferric chloride in solution.

5. Preparation of standard decinormal solution of potassium dichromate and Standardization of sodium thiosulphate solution and estimation of copper sulphate in solution.
6. Estimation of a mixture of oxalic acid and sulphuric acid in a solution using potassium permanganate solution and standard sodium hydroxide solution.

Note:a) AR/GR chemicals should be used for preparing the stock solutions and reagents.

b) At least grade B pipette should be used.

c) The candidates must be provided with 250cm³ volumetric flask and 25 cm³ pipettes.

d)The different volumes(in the range 20-30 cm³) of 1N solutions meant for estimation should be pipetted out by the examiners in 250 cm³ volumetric flasks so that not more than 3 candidates in a batch get the same value of 1N solutions distributed.

VALUATION SCHEME:

1. Class records:

Marks-10

The records certified by the teacher in charge and head of the Chemistry Department should be valued by the examiners.

i) Marks for experiments recorded : 7 marks

ii) Marks for neatness : 3 marks

2. Procedure writing

Marks-10

Essential details of procedure=6 marks

Tabulation and calculation =4marks.

3. Actual estimation:

Marks-20

i) Titre values 16 marks:

Errors	Standardization (Marks)	Estimation (Marks)
±0.2 cm ³	8	8
±0.3 cm ³	7	7
±0.4 cm ³	5	5
±0.5 cm ³	4	4
±0.6 cm ³	3	3
Any other value	2	2

NOTE: Candidates should retain only three titre values on each set of titrations out of which two concordant values are to be considered. All other values must be struck off by the candidates . If a candidate records more than three titre values ,first three values are to be considered and extra titre values are to be ignored .In case the candidate records only one titre value , only 50% of the marks are to be awarded in each case . Examiners are requested to bring this to the notice of the candidates. Every burette reading shall be attested by one of the examiners.

ii) Calculations (4 marks)

Normality of prepared solution = 1 mark

Normality of link solution = 1 mark

Final step = 2 marks

MANGLORE UNIVERSITY

Scheme of Practical Examinations and Valuation Procedures for B.Sc. Chemistry Practicals

BSc –II Semester BSCCHP182: Chemistry Practical – II

Duration: 3Hrs

Max. Marks: 40 (Practical-30; Class Record- 10)

The practical examination shall consist of the following:

Q.1.Exercise set for procedure writing

10 Marks:

Outline of the procedure to be written within first 15 minutes. Any of the exercise in the syllabus under chromatography may be given for this purpose, irrespective of whether a candidate has carried out experiment or not.

Determination of R_f values and identification of organic compounds

A. Thin Layer Chromatography

1. Separation of green leaf pigments.
2. Separation of mixture of dyes using cyclohexane and ethyl acetate (8.5:1.5).

B. Paper Chromatography: Ascending and Circular

1. Separation of mixture of phenylalanine and glycine, alanine and aspartic acid, Leucine and glutamic acid. Spray reagent – ninhydrin.
2. Separation of mixture of D,L-alanine, glycine, L- Leucine using n-butanol-acetic acid-water(4:1:5). Spray reagent – ninhydrin.

C. Column Chromatography:

1. Separation of Fluorescein and methylene blue.
2. Separation of leaf pigments from spinach leaves.

Q.2.Exercise set for Organic analysis.

20 Marks:

Any one of the following compounds may be given for analysis:

Resorcinol, oxalic acid, Urea, thiourea, Benzoic acid, p-Cresol, p- toluidine, Chlorobenzene, Bromobenzene, Nitrobenzene, Benzaldehyde, Acetophenone, Benzamide, Aniline.

VALUATION SCHEME:

1. Class records:

10 marks

The records certified by the teacher in charge and head of the chemistry Department should be valued by the examiners.

- | | |
|-----------------------------------|-----------|
| i) Marks for experiments recorded | : 7 marks |
| ii) Marks for neatness | : 3 marks |

2. Procedure writing

10 Marks

Essential details of procedure	8 marks
--------------------------------	---------

Calculation	2marks	
3. Organic analysis		20 Marks
Preliminary tests	1 mark	
Physical constant	3 marks (<2% error)	
Detection of elements (Tests for nitrogen, halogen and sulphur)	4 marks	
Solubility	4 marks	
Reactions of functional group (Any two)	6 marks	
Name and structure	2 marks	

MANGLORE UNIVERSITY

Scheme of Practical Examinations and Valuation Procedures for B.Sc. Chemistry Practicals

BSc – III Semester BSCCHP232: Chemistry Practical – III

Duration: 3Hrs

Max. Marks: 40 (Practical-30; Class Record- 10)

The practical examination shall consist of the following:

Q.1 Written viva on the principle of qualitative inorganic analysis 6
Marks

Q.2 Exercise set for inorganic qualitative analysis **24**
marks

1. Inorganic systematic qualitative analysis of a mixture of two simple salts containing two anions and two cations using semi micro technique
2. A simple powdered mixture of inorganic salts containing two anions and two cations is to be prepared on the spot by examiners from simple salts having the following anions and cations.

Anions: CO_3^{2-} , Cl^- , Br^- , I^- , NO_3^- , BO_3^{3-} , PO_4^{3-} , SO_4^{2-}

Cations: Pb^{2+} , Cd^{2+} , Al^{3+} , Mn^{2+} , Zn^{2+} , Ba^{2+} , Ca^{2+} , Sr^{2+} , Mg^{2+} , Na^+ , K^+ , NH_4^+

Note:

1. Mixture requiring elimination of phosphate and borate radicals must be avoided (avoid cations such as Ba^{2+} , Ca^{2+} , Sr^{2+} , Mg^{2+} when borate or phosphate radicals are given)
2. Mixtures of salts which on double decomposition form precipitates insoluble in dilute HCl (like BaSO_4 , SrSO_4 , PbSO_4) should not be given.
3. Combination like NO_3^- and Br^- , NO_3^- and I^- , Cl^- and I^- , Cl^- and Br^- , Cl^- and NO_3^- , Br^- and I^- must be avoided.
4. The cations should belong to different groups. For example, a combination of Ca^{2+} and Sr^{2+} , Ba^{2+} and Ca^{2+} , Ba^{2+} and Sr^{2+} , Mg^{2+} and Na^+ , Na^+ and K^+ , Mg^{2+} and K^+ , Al^{3+} and Mn^{2+} , Mn^{2+} and Zn^{2+} , must be avoided.
5. AR or GR grade chemicals should be used for preparing mixtures.
6. Different mixtures should be prepared and distributed to the candidates (by lots) so that not more than three candidates in a batch get the same mixture.
7. In case of cations, recording of tests are to be done until two cations are detected and confirmed.

Valuation scheme

1. Class records:

10marks

The records certified by the teacher in charge and head of the chemistry Department should be valued by the examiners.

- | | |
|-----------------------------------|-----------|
| i) Marks for experiments recorded | : 7 marks |
| ii) Marks for neatness | : 3 marks |

2. Written viva

6 marks

Viva questions should be exclusively from the prescribed practical syllabus.

3. Inorganic qualitative analysis

24 marks

The radicals should be reported along with proper chemical tests done systematically.

Four radicals reported correctly	24 marks
Three radicals reported correctly	18 marks
Two radicals reported correctly	12 marks
One radicals reported correctly	6 marks

Note:

- 1) For detecting only the group to which the cations belong, two marks for each correct group should be given
- 2) If more than four radicals are reported, reduce six marks for each extra radical reported
- 3) In the case of anions, confirmatory test is not to be expected for SO_4^{2-} and CO_3^{2-}
4. In the case of cations, confirmatory test is to be expected only in the case of NH_4^+
5. Flame test may be considered only as one of the preliminary test and not as a conclusive test for cations
6. In case of anions, positive tests should be recorded in detail while the essential negative tests may be record in brief.
7. If the charge on the radical not reported correctly deduct one mark for each wrong report.

MANGLORE UNIVERSITY

Scheme of Practical Examinations and Valuation Procedures for B.Sc. Chemistry Practicals

BSc – IV Semester BSCCHP282: Chemistry Practical – IV

Duration: 3Hrs

Max. Marks: 40 (Practical-30; Class Record- 10)

The practical examination shall consist of the following:

Q.1. Written viva

6 Marks

Any one of the exercises prescribed for the practical IV may be given for this purpose.

2. Any one of the following physical chemistry experiments may be set for the actual experimental work

24 marks:

1. Determination of density and surface tension of the given liquid (specific gravity bottle and stalagmometer to be supplied).
2. Determination of density and Viscosity of the given liquid (specific gravity bottle and viscometer to be supplied).
3. Determination of molecular mass of the given non-volatile solute by Walker-Lumsden method (molecular mass of the solute should not be more than 140. Electrolyte such as KCl, NaCl, $\text{BaCl}_2 \cdot 2\text{H}_2\text{O}$ also may be included).
4. a) Determination of miscibility temperature of the following systems.
 - i) 5cm^3 of phenol + 4cm^3 of water + 1cm^3 of 1% NaCl solution
 - ii) 5cm^3 of phenol + 3cm^3 of water + 2cm^3 of 1% NaCl solution
 - iii) 5cm^3 of phenol + 2cm^3 of water + 3cm^3 of 1% NaCl solution
 - iv) 5cm^3 of phenol + 1cm^3 of water + 4cm^3 of 1% NaCl solution
 - v) 5cm^3 of phenol + 5cm^3 of 1% NaCl solution of unknown concentrationb) From the data obtained, find out the unknown concentration of the sodium chloride solution

- graphically. (Pipettes with safety device be provided for pipetting out phenol).
- Determination of specific reaction rate for the acid hydrolysis of methyl acetate at a given temperature using 0.5N HCl or 0.5N H₂SO₄ (acid to be provided by the examiners)
 - Determination of % of toluene in a mixture of toluene + alcohol by refractometry.

Valuation scheme

1. Class records:

: 10marks

The records certified by the teacher in charge and head of the chemistry Department should be valued by the examiners.

- Marks for experiments recorded : 7 marks
- Marks for neatness : 3 marks

2. Written viva

6marks

Viva questions should be exclusively from the prescribed practical syllabus.

3. Physical chemistry experiments

24marks

Experiment (1): Density and Surface tension

Marking of density values

- Errors $\pm 1\%$: 10 marks
 $\pm 2\%$: 8 marks
 $\pm 3\%$: 7 marks
 $\pm 5\%$: 5 marks
 $\pm 10\%$: 3marks

Any other value: 2 marks

Calculations : 2+2= 4

surface tension values

- Errors upto $\pm 8\%$: 10 marks
 $\pm 8\%$ to $\pm 12\%$: 8 marks
 $\pm 12\%$ to $\pm 15\%$: 5 marks
 $\pm 15\%$ to $\pm 25\%$: 3 marks
 any other value : 2 marks

Experiment (2): Density and Viscosity

Marking of density values

- Errors $\pm 1\%$: 10 marks
 $\pm 2\%$: 8 marks
 $\pm 3\%$: 7 marks
 $\pm 5\%$: 5 marks
 $\pm 10\%$: 3marks

Any other value: 2 marks

Calculations : 2+2= 4

Viscosity values

- Errors upto $\pm 5\%$: 10 marks
 $\pm 8\%$ to $\pm 7\%$: 8 marks
 $\pm 12\%$ to $\pm 9\%$: 5 marks
 $\pm 15\%$ to $\pm 12\%$: 3 marks
 any other value : 2 marks

Experiment (3): Molecular mass

- Error upto $\pm 10\%$: 20 marks
 $\pm 10\%$ to $\pm 15\%$: 18 marks
 $\pm 15\%$ to $\pm 20\%$: 16 marks
 $\pm 20\%$ to $\pm 25\%$: 12 marks
 $\pm 25\%$ to $\pm 30\%$: 8 marks
 Any other value : 4 marks
 Calculation : 4 marks

NOTE: Candidates shall not retain more than three values in the answer book. Out of which best two values are to be considered for valuation. If a candidate records more than three values, first three recorded are to be considered.

Experiment (4) : Miscibility Temperature

- 1% NaCl stock solution should be provided by the examiners
- Unknown concentration to be given should be in between 0.3% - 0.7%
- Graph drawn : 4 marks

(Proportionate marks are to be deduced, if the graph is not properly drawn for the given set of points.)

Error in concentration (unknown)

Upto $\pm 5\%$: 20 marks
$\pm 5\%$ to $\pm 8\%$: 18 marks
$\pm 8\%$ to $\pm 12\%$: 16 marks
$\pm 12\%$ to $\pm 15\%$: 12 marks
15% to 20%	: 8 marks
Any other values	: 4 marks

Experiment (5) Chemical kinetics

Graph drawn: 5 marks Calculation: 5 marks

Error Up to $\pm 5\%$: 14 marks
$\pm 5\%$ to $\pm 10\%$: 12 marks
$\pm 10\%$ to $\pm 15\%$: 10 marks
$\pm 10\%$ to $\pm 15\%$: 8 marks
15% to 20%	: 6 marks
Any other values:	3 marks

Experiment (6): Analysis of a liquid Mixture by Refractometry.

a) Graph drawn: 4 marks

Best straight line graph with at least 4 points - 4 marks.

Less than four points - 3 marks.

b) Percentage composition of the given mixture in the range.

$\pm 5\%$: 20 marks
$\pm 7\%$: 16 marks
$\pm 9\%$: 12 marks
$\pm 12\%$: 8 marks
Any other values	: 4 marks

Standard binary liquid mixtures of known compositions are to be prepared fresh by the candidates.

Unknown is given by the examiners.

NOTE: In all the above experiments if the calculation is wrong no marks to be given for calculation part, but the examiners are required to calculate the values and award the marks as per scheme.

MANGLORE UNIVERSITY

Scheme of Practical Examinations and Valuation Procedures for B.Sc. Chemistry Practicals

BSc – V Semester BSCCHP333: Chemistry Practical – V

Duration: 4Hrs

Max. Marks: 80 (Practical-70; Class Record- 10)

The practical examination shall consist of the following:

Q.1. `Written viva **10 marks**

Q2.Gravimetric Exercise: **45 Marks**

Examiners shall supply the solution in two 400cm³ beakers, for each of the candidates, such that the mass of the precipitate will be in the range of 0.2 to 0.3g. A brief outline of the procedure is to be given. The candidates are required to perform two trials each using the given solutions.

One of the following exercises may be set for the gravimetric exercise.

1. Estimation of barium as barium sulphate in barium chloride solution.
2. Estimation of copper as cuprous thiocyanate in copper sulphate solution.
3. Estimation of Ni as Nickel dimethyl glyoximate in nickel ammonium sulphate solution.
4. Estimation of iron as ferric oxide in ferrous ammonium sulphate solution.
5. Gravimetric estimation of chloride / silver as AgCl in NaCl/AgNO₃ solution.
6. Estimation of magnesium as oxinate in magnesium sulphate solution.

Q3.Colorimetry/Food Adulteration: **15 marks**

One of the following experiments may be set:

- a. To verify Beer-Lambert Law by Job's or Mole-ratio method
- b. Detection of adulterants in food stuffs

VALUATION SCHEME:

Distribution of marks:

1. Class records: **10 marks**

The records certified by the teacher in charge and head of the chemistry Department should be valued by the examiners.

- | | |
|-----------------------------------|-----------|
| i) Marks for experiments recorded | : 7 marks |
| ii) Marks for neatness | : 3 marks |

2. Written viva **10 marks**

Viva questions should be exclusively from the prescribed practical syllabus.

3. Gravimetric Exercise: **45 Marks**

- | | |
|----------------------------------|----|
| i) Marks for mass of precipitate | |
| ±2% | 40 |
| ±3% | 35 |
| ±4% | 30 |
| ±5% | 25 |
| ±6% | 20 |

Any other value	10	
ii) Calculation		5 marks

3. Colorimetry / Food Adulteration: 15 marks

Experiment (a):

- i) Good plot : 10 marks
(Proportionate marks are to be deducted, if the graph is not properly drawn for the given set of points.)
- ii) Tabulation and Calculation : 5 marks

Experiment (b):

Adulterated milk, ghee /butter, edible oil / sugar are to be given

- Detecting adulterants in milk : 5 marks
 Detecting adulterants in ghee/ butter: : 5 marks
 Detecting adulterants in sugar/edible oil : 5 marks

MANGLORE UNIVERSITY

Scheme of Practical Examinations and Valuation Procedures for B.Sc. Chemistry Practicals

BSc – VI Semester BSCCHP383: Chemistry Practical – VI

Duration: 4Hrs

Max. Marks: 80 (Practical-70; Class Record- 10)

The practical examination shall consist of the following:

Q.1.Exercise set for procedure writing 10 Marks

Outline the procedure for preparation of any one of the following inorganic complexes with equation within 15 minutes.

- a.Preparation of sodium trisoxalato ferrate (III), $\text{Na}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$
 b.Preparation of copper tetraammine complex, $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4$
 c.Preparation of hexaammine cobalt (III) chloride, $[\text{Co}(\text{NH}_3)_6]\text{Cl}_2$

Q. 2.Prepare any one of the following organic compound, determine its melting point and present the crude and recrystallised sample for inspection. 15 Marks

- a. Acetanilide
 b. p-bromoacetanilide
 c. Benzoic acid

Q.3. Perform one of the following experiments 35 Marks

- a) To determine the strength of the given acid mixture (acetic acid + hydrochloric acid) conductometrically using standard alkali solution.
 b) To determine the equivalent conductance of sodium chloride by conductometric method.
 c) Potentiometric titration of ferrous ammonium sulphate using potassium dichromate as titrant and calculation of the redox potential of $\text{Fe}^{3+} / \text{Fe}^{2+}$ system on the hydrogen scale.
 d) To determine the dissociation constant of a weak acid by potentiometric method
 e) To determine the concentration of Cupric ions present in a solution using a colorimeter.

Q.4. Viva to be conducted during practicals 10 marks

Viva questions should be exclusively from the prescribed practical syllabus.

VALUATION SCHEME:

Distribution of marks:

I. Class records:

10 marks

The records certified by the teacher in charge and head of the chemistry Department should be valued by the examiners.

- | | | |
|-----------------------------------|---|---|
| i) Marks for experiments recorded | : | 7 |
| ii) Marks for neatness | : | 3 |

2. Procedure writing:

10 marks

- | | | |
|--------------------------------|---|---------|
| Outline with essential details | : | 8 marks |
| Chemical Equation | : | 2marks |

3. Viva to be conducted during practicals

10 marks

4. Preparation of organic compounds

15 marks

- | | | |
|--|---|-----------------------|
| i) Marks for preparation of crude sample | : | 7 |
| ii) Yield (upto $\pm 20\%$ of theoretical value) | : | 3 any other value : 1 |
| iii) Marks for recrystallisation | : | 2 |
| vi) Marks for melting point (upto $\pm 3\%$) | : | 3 any other value:1 |

5. Instrumental method

35 marks

a. To determine the strength of the given acid mixture (acetic acid + hydrochloric acid) Conductometrically using standard alkali solution

- | | | | |
|------------------------------|--------------|--|-------|
| i. Graph | (good plot) | | 10 |
| | other plots | | 6 |
| ii. Error in titre values | ± 0.2 ml | | 10+10 |
| | ± 0.3 ml | | 8+8 |
| | ± 0.4 ml | | 6+6 |
| | ± 0.5 ml | | 4+4 |
| | Other values | | 2+2 |
| iii. Calculation of strength | | | 5 |

b. To determine the equivalent conductance of sodium chloride by conductometric method.

- | | | |
|--|---------------|----|
| i. Cell constant | | |
| Calculation | | 2 |
| Correct value | | 3 |
| ii. Equivalent conductance | | |
| Calculation of equivalent conductance values | | 15 |
| iii. Graph | (good plot) | 10 |
| | other plot | 6 |
| iv. Correct value of equivalent conductance at infinite dilution | | 5 |

c. Potentiometric titration of ferrous ammonium sulphate using potassium dichromate as titrant and calculation of the redox potential of Fe^{3+} / Fe^{2+} system on the hydrogen scale

- | | | | |
|--------------------------|--------------|----|--------|
| i) Graphs | (good plots) | 16 | (8+8) |
| | Other plots | 8 | (4+4) |
| ii) Error in titre value | ± 0.2 ml | 15 | |
| | ± 0.3 ml | 12 | |
| | ± 0.4 ml | 9 | |
| | ± 0.5 ml | 6 | |
| | Other values | 3 | |

iii. Calculation of redox potential		4
d. To determine the dissociation constant of a weak acid by potentiometric method		
I Graph	(good plots)	10(5+5)
	Other plots	6 each
ii. Error in titre value	$\pm 0.2\text{ml}$	15
	$\pm 0.3\text{ml}$	12
	$\pm 0.4\text{ml}$	9
	$\pm 0.5\text{ml}$	6
	Other values	3
iii. Calculation of dissociation constant		10
e. To determine the concentration of Cupric ions present in a solution using a colorimeter (The unknown solution should be in the range of 4 to 6 mM concentration)		
i. Graph	(good plot)	10
	Other plots	6
ii. Error in concentration	$\pm 0.2\text{ mM}$	25
	$\pm 0.3\text{ mM}$	20
	$\pm 0.4\text{ mM}$	15
	$\pm 0.6\text{mM}$	10
	Other values	5

MANGALORE UNIVESITY
CHOICE BASED CREDIT SYSTEM
COURSE PATTERN AND SCHEME OF EXAMINATION
CORE SUBJECT: CHEMISTRY

Core/ Elective	Paper Code	Title of the Paper	Instru- ction Hours	Duration of the Examinati on(Hrs.)	Max. Marks			Cre- dits
					Exam	IA	Total	
I Semester B.Sc.								
Group I Core Subject	Theory BSc CHC- 131	Chemistry Paper I	4	3	80	20	100	2
	Practical BSc CHP- 132	Chemistry Practical I	3	3	40	10	50	1
Group II Elective	Theory BSc CHCE 133	Food Chemistry & Biomolecules	2	2	40	10	50	1*
Total number of Credits for Subject in I Semester:04								
II Semester B.Sc.								
Group I Core Subject	Theory BSC CHC- 181	Chemistry Paper II	4	3	80	20	100	2
	Practical BSc CHP- 182	Chemistry Practical II	3	3	40	10	50	1
Group II Elective	Theory BSc CHCE- 183	Computer for Chemists & Laboratory Safety Techniques	2	2	40	10	50	1*
Total number of Credits for Subject in II Semester:04								
III Semester B.Sc.								
Group I Core Subject	Theory BSC CHC- 231	Chemistry Paper III	4	3	80	20	100	2
	Practical BSC CHP- 232	Chemistry Practical III	3	3	40	10	50	1
Group II Elective	Theory BSc CHCE- 233	Corrosion and Green Techniques	2	2	40	10	50	1*
Total number of Credits for Subject in III Semester:04								

IV Semester B.Sc.

Group I Core Subject	Theory BSc CHC- 281	Chemistry Paper IV	4	3	80	20	100	2
	Practical BSc CHP- 282	Chemistry Practical IV	3	3	40	10	50	1
Group II Elective	Theory BSC CHOE- 283	Chemistry in everyday life	2	2	40	10	50	1*

Total number of Credits for Subject in IV Semester:04

V Semester B.Sc.

Group I Core Subject	Theory BSc CHC- 331	Chemistry Paper V	3	3	80	20	100	2
	Theory BSc CHC- 332	Chemistry Paper VI	3	3	80	20	100	2
	Practical BSc CHP- 333	Chemistry Practical V	4	4	80	20	100	2

Total number of Credits for Subject in V Semester:06

VI Semester B.Sc.

Group I Core Subject	Theory BSc CHC- 381	Chemistry Paper VII	3	3	80	20	100	2
	Theory BSc CHC- 382	Chemistry Paper VIII	3	3	80	20	100	2
	Practical BSc CHP- 383	Chemistry Practical VI	4	4	80	20	100	2

Total number of Credits for Subject in I Semester to IV Semester:16

Total number of Credits for Core Subject in I-VI Semesters:28

*Credits for Elective Papers will be considered for the entire B.Sc. Programme

I-Semester

Food Chemistry and Biomolecules

UNIT I

Food and Nutrition: Introduction, Terminology used in food chemistry, classification of food, pH of foods., functions. Food as source of energy and structural material. Components of food – Carbohydrates, Proteins, Oils and Fats. Micronutrients-Vitamins, minerals. Chemical substances used in food preparation - water, common salt, baking powder, vinegar. Digestion of food- dissolution in the mouth, digestion in stomach and small intestine, absorption of food. Digestion of carbohydrates, proteins, oils and fats - Explanation. Food Processing. drying, salting, canning, pickling, smoking, packing and refrigeration Food additives, emulsifying agents, Texturing agents, flavoring and coloring agents ,antioxidants, sweeteners ,low caloric sweeteners, artificial sweeteners like glycamates,D-aminoacids,saccharin,aspartame,designer sweetners,sugar alcohols,corn sweeteners

Naturally occurring sweeteners: Stevioside, Monellin,curculin,Pentodin, Isovanillyll sweeteners .
Soft drinks-Components. Effects on health. 12hrs.

Unit-II

Vitamins :Introduction, classification,Fat soluble vitamins, source of vitamin, vitamin D, Niacin, structure and synthesis. Water soluble vitamins, pantothenic acid, cyanocobalamin, synthesis ,structure and deficiency disease's.

Photosynthesis of carbohydrate, mechanism of light phase reaction,.

Proteines : Oxytocin and vasopressin ,chemical synthesis and biological activity.

Antibiotics, Introduction, classification, synthesis of chloramphenicol

Lipids: Introduction, occurrence,biological functions,chemical and physical properties, Derived lipids, cholesterol and its biological functions 12hrs.

Reference Books:

1. Food: The Chemistry of its components-Tom Coultate, Kindle Edition.
2. Food Science and Technology-Geoffrey Campbelt-Platt,Wiley Blackwell, Kindle Edition.
3. Chemistry at Home: Exploring the ingredients in everyday products- John Emsley, Royal Society of Chemistry (2015).
4. Chemistry in daily life - Kripal Singh, Third Edition, Eastern Academy Education, PHI Learning Pvt. Ltd, New Delhi(2012).
5. Chemistry in everyday life-Shardendu Kislaya, Discovery Publishing House Pvt.Ltd(2011).
6. Food chemistry by H.K.Chopra and P.S.Panesar (Narosa Publishing)
7. Organic Chemistry of Natural Products,By Gurudeep R.Charwal(Vol-I and II) ,edited by M.Arora(Himalaya Publishing House)

II semester: Computers for Chemists, Laboratory Safety and Chemotherapy

UNIT I

Computers for Chemists

Basic structure and functioning of computer with a PC as an illustrative example.

Memory, Input/output devices, Secondary storage, Computer languages, Operating systems, Algorithm and Flow chart, programmes and packages, MS-word, EXCEL, PPT, CHEM SKETCH etc.

Demonstration and writing and drawing of chemical formulae and structure through chem sketch.

Plotting the various graphs such as pressure-volume (PV), pressure- temperature (PT), potentiometric, conductometric and colorimetric plots through EXCEL. 8h

LABORATORY SAFETY

Introduction. General laboratory protocols: Basic rules, Good Laboratory Practices. Chemical hazards, safety data sheets, symbols and hazard information, storage procedure, Physical hazards, Health hazards, Reaction hazards. Assessing the risks of hazards. Minimizing the risks of hazards: fume hood, ventilation, fire extinguisher, personal protective equipment's, Preparedness for emergencies from uncontrolled hazards: Importance of reporting incidents, response to common emergencies such as fires, explosions, chemical spills, chemical exposures, injuries. 4h

UNIT II

SERENDIPITY

The role of Chance in making Scientific Discoveries

What is Serendipity- Some Serendipous Inventions in Science; Guncotton, Velcro, Plastic, X-rays, Microwave, Superglue, Mauve, Teflon, Saccharin, Stainless steel, Matches. Role of Serendipity in Drug discovery; Inventions in Chemistry that enabled the modern world. 3h

CHEMOTHERAPY

Introduction. Classification – antibiotics-Chloramphenicol and Pencillin. Synthesis and Uses. Analgesics – Narcotic analgesics and Non-Narcotic analgesics-Examples and their uses. (Simple Synthesis to be included).

Sulphonamides-Preparation of sulphonamides.-Examples and their uses. Antiseptics and disinfectants-Examples and their uses. Hypoglycemic agents –Cancer treatment by Chemotherapy.

A brief account of medicinally important compounds. Compounds of aluminum as pharmaceuticals; compounds of phosphorous as pharmaceuticals; Compounds of iron as pharmaceuticals. Examples and uses. (Only specific examples) 4h

Laboratory Reagents:

Preparation of laboratory reagents and maintenance of electrodes and equipment's. Methods of expressing concentrations of solution, Preparation of reagents for qualitative analysis of organic and inorganic compounds. Precaution and safety measures during reagent preparation. 5h.

References:

1. Laboratory Safety, theory and Practice, 1st Edition, Editors: Anthony Fuscaldo and others Elsevier Publications, 1980.
2. Chemical Laboratory Safety and Security: A Guide to Developing Standard Operating Procedures. National Academies Press (2016). Board on Chemical Sciences and Technology, Division on Earth and Life Studies.
3. Chemistry Laboratory Safety Manual, Indian Institute of Science Education and Research, Tirupati.
4. Laboratory Safety Manual, NCBS, 2016.
5. Pharmaceutical Chemistry by Thyagarajan.
6. Science and serendipity: Famous accidental discoveries, Samira Shackle, Thursday, 2nd April 2015- NEW HUMANIST.
7. The role of serendipity in drug discovery. Thomas A. Ban, MD, FRCP- Dialogues in Clinical Neuroscience, 2006 Sep; 8(3): 335–344.
8. Five Chemistry Inventions that changed the modern world-THE CONVERSATION. June 2, 2015
9. Hannan, Patrick J. (2006). Serendipity, Luck and Wisdom in Research; Universe. ISBN 0-595-36551-5.
10. Practical Chemistry- Dr. O.P.Pandey, D.N. Bajpai, Dr. S. Giri
11. Vogel's Qualitative Inorganic Analysis- G. Svehla
12. Computers and their applications to Chemistry – Ramesh Kamari
13. Computers in Modern Chemistry – A. Kumar

III-Semester : Corrosion and Green Techniques

UNIT I

Corrosion : Introduction, definition, Types of corrosion, Galvanic corrosion, Crevice corrosion, Pitting corrosion, Erosion corrosion, Stress corrosion, Corrosion rate, - definition, Factors affecting on corrosion rate

Metallic factor-Purity, Electrode Potential of metal, hydrogen over voltage, nature of corrosion product

Environmental factors-Temperature, pH of the medium, humidity, presence of impurities, electrical conductivity of the medium, velocity of the medium, concentration of the medium.

Prevention of corrosion: Material selection-Metals and alloys, metal purification, non-metallic, Alteration of environment-Changing media, inhibitors, Design-wall thickness, design rules, Coating-Metallic and other inorganic coatings, organic coating

Unit-II

Green Chemistry-Introduction, Principles, atom-economy, Prevention of waste, byproducts, hazardous products/chemicals, water as a solvent for organic reactions, ionic liquids, solidstate-solventless reactions, use of microwaves, careful use of protecting and deprotecting agents, use of catalytic reagents, Phase transfer catalysts and its synthetic applications.

Examples of Green synthesis: Synthesis of adipic acid, catechol, disodium iminodiacetate, Boots synthesis of brufen, Microwave assisted reactions in water-Hofmann elimination, Methyl benzoate to benzoic acid, oxidation of toluene and alcohols

Microwave assisted reactions in organic solvents:-Diels-Alder reaction and decarboxylation reaction, Green synthesis of compostable and widely applicable polylactic acid, plastic from corn.

Limitations of green techniques.

References:

1. Laboratory Safety, theory and Practice, 1st Edition, Editors: Anthony Fuscaldo and others. Elsevier Publications, 1980.
2. Chemical Laboratory Safety and Security: A Guide to Developing Standard Operating Procedures. National Academies Press (2016). Board on Chemical Sciences and Technology , Division on Earth and Life Studies.
3. Chemistry Laboratory Safety Manual, Indian Institute of Science Education and Research, Tirupati.
4. Laboratory Safety Manual, NCBS, 2016.
5. Text book of Physical Chemistry By Puri, Sharma and Pathania
- 6.
7. text book of ElectroChemistry By Glaston
8. Text book of Physical Chemistry By Atkins
9. Text book of Physical Chemistry By Bahl and Bahl
10. Text book of Physical Chemistry By Gurudeep Raj
11. Pharmaceutical Chemistry by Thyagarajan

Semester IV : Chemistry in Daily Life (Open Elective)

UNIT I

Food: Food as source of energy and structural material. Components of food – Carbohydrates, Proteins, Oils and Fats. Micronutrients-Vitamins, minerals. Chemical substances used in food preparation - water, common salt, baking powder, vinegar. Digestion of food- dissolution in the mouth, digestion in stomach and small intestine, absorption of food. Digestion of carbohydrates, proteins, oils and fats - Explanation. Food Processing. Food additives, preservatives and flavours. Explanation with examples for the preservation of food by the use of inhibitors, drying, salting, canning, pickling, smoking, packing and refrigeration. Food safety. Soft drinks- Components. Effects on health. 6 Hrs

Chemistry for our household requirements

Cleansing agents: Chemical composition of Soaps, detergents, dish washers, drain cleaners, bleaching powder, Tooth paste and shampoo. Stain removers – Explanation with some common examples.

Domestic items: Safety matches, wax candles, shoe polish, mosquito coils, household germicides and pesticides-their chemical composition.

Cosmetics: Talcum powder, nail polish, thinners, skin care, hair care, Lipsticks, sun protection lotions and creams, eye shadow and eyebrow pencils, antiperspirants, perfumes and deodorants- explanation with examples. 6 Hrs

UNIT

Chemistry for our future

Alternative sources of energy: Need for the search of renewable sources of energy.

Solar Energy: Basic properties of solar energy. Applications of solar energy. Transformation of solar energy. Solar heat collectors. Solar photovoltaic collectors. Applications of solar collectors. Examples. Solar power plant.

Wind Energy: Basic properties of wind energy. Applications of wind energy. Transformation of wind energy. Wind turbines. Operative characteristics of wind turbines. Wind power plant. Utilization of wind power. Examples. Trends in wind energy utilization.

Hydro power: Basic properties water energy. Transformation of water energy. Hydro power plant. Utilisation of hydro power. Examples. Trends in hydro power utilization. 6hrs.

Hydrogen energy: Production and applications.

Food adulterations-Definition, common harmful effects, detection of adulteration, Prevention, Food adulteration act, artificial ripening of fruits, explanation with examples'. Transformation of biomass energy. Applications of biomass.

Ocean energy- Principles of ocean thermal energy, conversion system. Principles of wave and tidal energy conversion. 6 Hrs

Reference Books:

1. Food: The Chemistry of its components-Tom Coultate, Kindle Edition.
2. Food Science and Technology-Geoffrey Campbelt-Platt,Wiley Blackwell, Kindle Edition.
3. Chemistry at Home: Exploring the ingredients in everyday products- John Emsley, Royal Society of Chemistry(2015).
4. Chemistry in daily life - Kirpal Singh, Third Edition, Eastern Academy Education, PHI Learning Pvt. Ltd, New Delhi(2012).
5. Chemistry in everyday life-Shardendu Kislaya, Discovery Publishing House Pvt.Ltd(2011).

6. Renewable energy sources and emerging technologies-D.P.Kothari, K.C.Singal and Rakesh Ranjan, Eastern Economy Edition.
7. Solar energy: fundamentals and applications- H.P.Garg and J.Prakash, Mc Graw Hill, First Revised Edition.
8. Biomass regenerable energy-D.O.Hall and R.P.Overend, Wiley-Blackwel(1987).
9. Introduction to wind turbine aerodynamics – Alois Peter Schaffarczyk, Springer(2014).
10. Hydrogen and fuel cells: Fundamentals, technologies and applications-Detlef Stolten, Wiley-Vest(2010).
11. New Trends in Green Chemistry - Ahluwalia V.K and Kidwai M.R, Anamalaya Publishers (2005).
12. Green Chemistry - Theory and Practical, Anastas, P.T and Warner J.K : Oxford University Press (1998).
13. Introduction to Green Chemistry- Matlack, A.S. Marcel Dekker (2001).
14. Introduction to Green Chemistry- Ryan, M.A. & Tinnesand, M., American Chemical Society, Washington (2002).
