QUEEN MARY'S COLLEGE (A), CHENNAI-4

DEPARTMENT OF CHEMISTRY

B.Sc. SYLLABUS

CHOICE BASED CREDIT SYSTEM

ACADEMIC YEAR 2022-2023 ONWARDS

CONTENT

LIST OF PAPERS WITH CREDITS FOR THE PROPOSED NEW SYLLABUS FOR THE BATCH 2022-2023 ONWARDS

SEM	C/E	COURSE NO.	COURSE CODE	TITLE	UE	IA	TOTAL	NO. OF CREDITS
I	C	I		Analytical Chemistry	75	25	100	5
I	C	II		Inorganic Chemistry-I	75	25	100	5
II	C	III		Organic Chemistry –I	75	25	100	5
II	**C**	**IV**		**Practical I - Volumetric Analysis**	**75**	**25**	**100**	**5**
III	C	V		Organic Chemistry –II	75	25	100	5
III	C	VI		Physical Chemistry-I	75	25	100	5
IV	C	VII		Inorganic Chemistry-II	75	25	100	5
IV	**C**	**VIII**		**Practical II- Semimicro Qualitative Analysis**	**75**	**25**	**100**	**5**
V	C	IX		Organic Chemistry-III	75	25	100	5
V	C	X		Inorganic Chemistry-III	75	25	100	5
V	C	XI		Physical Chemistry-II	75	25	100	5
V	**E**	**XII**		***Elective-I-A Fundamentals of Spectroscopy**	**75**	**25**	**100**	**5**
V	**E**	**XIII**		***Elective-I-B Polymer Chemistry**	**75**	**25**	**100**	**5**
V	**E**	**XIV**		***Elective-I-C Pharmaceutical Chemistry**	**75**	**25**	**100**	**5**
VI	**C**	**XV**		**Practical-III Physical Chemistry Experiments and Organic Preparation**	**75**	**25**	**100**	**5**
VI	C	XVI		Organic Chemistry – IV	75	25	100	5
VI	C	XVII		Inorganic Chemistry-IV	75	25	100	5
VI	C	XVIII		Physical Chemistry-III	75	25	100	5
VI	**E**	**XIX**		****Elective-II-A Chemistry of Materials**	**75**	**25**	**100**	**5**
VI	**E**	**XX**		****Elective-II-B Nano Chemistry**	**75**	**25**	**100**	**5**
VI	**E**	**XXI**		****Elective-II-C Industrial Chemistry**	**75**	**25**	**100**	**5**
VI	**C**	**XXII**		**Practical IV- Gravimetric Estimation and Organic analysis**	**75**	**25**	**100**	**5**
III	C	XXIII		Allied Chemistry-I	75	25	100	4
IV	C	XXIV		Allied Chemistry-II	75	25	100	4

IV	**C**	**XXV**		**Allied Chemistry Practicals**	**75**	**25**	**100**	**2**
III	E (other major)	XXVI		Medicinal Chemistry	75	25	100	2
IV	E (other major)	XXVII		Chemistry in Day today life	75	25	100	2

*** Three options for Elective paper-I is given in V Semester; Of which, either Elective I-A or I-B or I-C can be chosen by the students.**

****Three options for Elective paper-II is given in VI Semester; Of which, either Elective II-A or II-B or II-C can be chosen by the students.**

CHOICE BASED CREDIT SYSTEM FOR UG- 2022-2023

Total No of Papers : 27 **Total Credits: 91**

Type of Paper	**No. of Paper**	**Credits Per Paper**	**Credits**
Core	16	5	80
Core Elective	2	5	10
Core-Allied	2	4	8
Core-Allied- Practical	1	2	2
Other Department Elective	2	2	4
Tamil	4	3	12
English	4	3	12
Other Department Allied- Maths	2	5	10
Other Department Allied- Zoology	2	4	8
Other Department Allied- Zoology Practical	1	2	2
Other Department Allied- Physics	2	4	8
Other Department Allied- Physics Practical	1	2	2
Soft Skill	6	2	12

- Out of 4 elective papers 2 elective papers will be offered by parent department (V, VI Semester)
- The remaining 2 elective papers will be offered to all Other UG students in the college (III and IV Semester)
- **Week - 6 working day order Semester – 15 such weeks**

S. No	Core/Elective	Hrs/Week	No. of Week	Total Hours/ Semester
1	Core	06	15	90
2	Elective	04	15	60

- Number of Units in the syllabus of core papers 05
- Number of Units in the syllabus of elective papers 05
- Maximum marks per paper 100
- **Total marks Core (Major+ Allied- Maths)- 2300**

QUESTION PAPER PATTERN - B.Sc. CHEMISTRY

CORE PAPERS & ELECTIVE PAPERS

Maximum Marks: 100 (Internal Assessment: 25, External Valuation: 75)

Time : 3 hrs. **Total marks: 75**

Without omitting any unit

Section – A

Answer All the questions: **[5 x 2 = 10]**

[5 Questions one from each unit without choice]

1.
2.
3.
4.
5.

Section – B

Answer All the questions: **[5 x 4 = 20]**

[2 questions from each unit with Either, Or choice]

6. a)
(OR)
b)
7. a)
(OR)
b)
8. a)
(OR)
b)
9. a)
(OR)
b)
10. a)
(OR)
b)

Section – C

Answer any THREE Questions: **[3 x 15 = 45]**

[3 questions to be answered out of 5 questions.
1 question from each unit]

11.
12.
13.
14.
15.

QUESTION PAPER PATTERN for PART – IV

UG Course – 2022 onwards

Question Paper Pattern for EVS, Value Education and NME

Time : 3 hrs **Total marks: 75**

Section – A

Answer Any 6 out of 10 questions: **[6 x 5 = 30 Marks]**

Section – B

Answer Any 3 out of 5 questions: **[3 x 15 = 45 Marks]**

Question Paper pattern for Soft Skills

Time : 3 hrs **Total marks: 75**

Section – A

Answer Any 6 out of 10 questions: **[10 x 2 = 20 Marks]**

Section – B

Answer Any 5 of the following paragraph questions: **[5 x 5 = 25 Marks]**

Section – C

Answer any THREE question in 200 word each: **[3 x 10 = 30 Marks]**

INTERNAL EVALUATION METHODOLOGY FOR ALL THE PROGRAMS

- ✓ Quiz programme or e-Quiz
- ✓ Periodical class tests
- ✓ Objective type assignments
- ✓ Problem solving assignments (INDIVIDUAL / GROUP)
- ✓ Individual seminar USING POWER POINT
- ✓ Seminar based on lecture notes available online
- ✓ Group Discussions / Debate / Interactive Sessions
- ✓ Digital computation exercises with spreadsheet or Excel wherever possible
- ✓ Oral presentation on Topics of interest

QUANTIFICATION OF INTERNAL EVALUATION - UG THEORY

- Minimum 2 Internal tests – Average of 2 Test
- Minimum 3 assignments – Average of 2 best assignments
- Model Examination for 75 marks reduced to 10 marks

TEST	ASSIGNMENT	ATTENDANCE	MODEL EXAM	TOTAL	CONTINUOUS INTERNAL ASSESSMENT
10	**10**	**5**	**75**	**100**	**-**
Reduced To					
5	**5**	**5**	**10**		**25**

PRACTICALS

Maximum Marks : 100

Internal Assessment : 25 **External Valuation: 75**

Model test for 75 marks reduced to 10 marks

Attendance	Observation	Record	Model	Total
5	5	5	10	25

Practical End Semester Exam
75

Passing minimum

University Examination 50%
Aggregate (CIA+UE) 50%
Grade Points and Cumulative Grade Point Average are awarded in the mark sheet

TEACHING METHODOLOGIES ADOPTED FOR THE UG PROGRAM

1. CHALK TALK
2. TEXT BOOK LEARNING
3. DIGITAL LEARNING- ONLINE PPT - LECTURE NOTES
4. VIDEO LECTURE – ONLINE – YOU TUBE – GOOGLE MEET - CLASSROOM

5. INTERACTIVE SESSIONS
6. STUDENT SEMINAR
7. LECTURE BY EXPERTS IN FIELD – INVITED TALKS
8. PARTICIPATORY LEARNING – LECTURES IN OTHER INSTITUTIONS

PROGRAM EDUCATIONAL OBJECTIVE (PEO):

In line with the institutional vision and mission, B.Sc Chemistry Programme aims to impart knowledge and skills to the students facilitating them to

- Pursue higher education and procure job opportunities through strong and ample learning of the core and related subjects with adequate exposure to digital literacy (PEO1)
- Utilize appropriate resources and tools to be life-long learners (PEO2)
- Improve leadership qualities with rational thinking and scientific temper

PROGRAM SPECIFIC OUTCOME (PSO):

After completing B.Sc Chemistry programme, the student will be able to

- Understand the major concepts, theoretical principles and experimental aspects of chemistry (PSO1: PO1)
- Communicate and transform effectively as a committed chemist or administrator in multidisciplinary environment (PSO2:PO9)
- Employ critical thinking and efficient problem-solving skills in the four basic areas of chemistry (Organic, Inorganic, Physical and Analytical Chemistry) and acquire analytical skills (PSO3:PO2)
- Work effectively in teams in laboratory, analyse data and interpret results while observing ethical scientific conduct (PSO4:PO7)
- Enhance digital skills by utilizing E-resources available for creative and efficient learning. (PSO5:PO3)

A chemistry graduate as envisioned in this framework would be sufficiently competent in the field to pursue discipline-specific higher studies as well as to begin domain-related employment.

PROGRAM OUTCOME (PO)

The aim of the UG program in Chemistry is to create an individual with higher knowledge in the subject concepts, develop good communication skills through writing the assignments, get inclined to analyse and solve problems, thereby making a significant contribution to the talent pool in chemistry. While pursuing the program, there will be abundant scope for students to gain strong foundation in fundamental as well as advanced concepts (**PO1**), enhance and explore communication skills (**PO2**), strengthen the problem solving skills (**PO3**), develop sense of enquiry (**PO4**), imbibe team spirit by working in groups (**PO5**), gain leadership attributes (**PO6**), enhance digital skills (**PO7**), reinforce ethical values (**PO8**), broaden their domain knowledge (**PO9**), develop aptitude for lifelong learning (**PO10**). The total correlation of skills for the program is arrived at by assessing the skill levels for each unit on a scale of 3 in which the value of 1, 2, and 3 correspond to low, moderate and strong correlation, respectively. Skill levels below 30 % are not correlated and left blank.

Graduate Attributes for B.Sc. Chemistry Programme

PO1. Disciplinary knowledge and skills : Ability to demonstrate deep knowledge in Analytical chemistry, inorganic chemistry, organic chemistry, physical chemistry, chemistry of materials, fundamentals of spectroscopy, Allied chemistry, Chemistry in day today life, Medicinal chemistry. Efficiency to use modern laboratory techniques to design and perform experiments in all the field of chemistry. (**PSO1**).

PO2. Skilled Communicator: Ability to express important concepts in a lucid manner through writing the assignments and group discussions and report writing by applying the methodologies learnt in soft skill courses. (**PSO6**).

PO3. Critical thinker and problem solver: Proficiency to employ deep analytical thinking and efficiently solve problems in all the areas of chemistry to face competitive examinations. Generate, develop and evaluate ideas, reflect on their learning and information related to their seminars and group discussions (**PSO3**).

PO4. Sense of inquiry: Skill to put forward inquisitive questions in group discussions and seminars. (**PSO4**).

PO5. Team player/worker: Ability to undertake team assignments/work through the experience gained in competitions (**PSO5**).

PO6. Skilled project Manager: Opportunities are given to organize and act as volunteers and a team to educate the public and school students about the importance of chemistry in trade fair conducted by the Tamilnadu government.

PO7. Digitally Efficient: Proficiency in using softwares for theoretical calculations in chemistry and drawing structures of compounds (chemdraw), a skill learnt in internship and CLP programmes (**PSO2**).

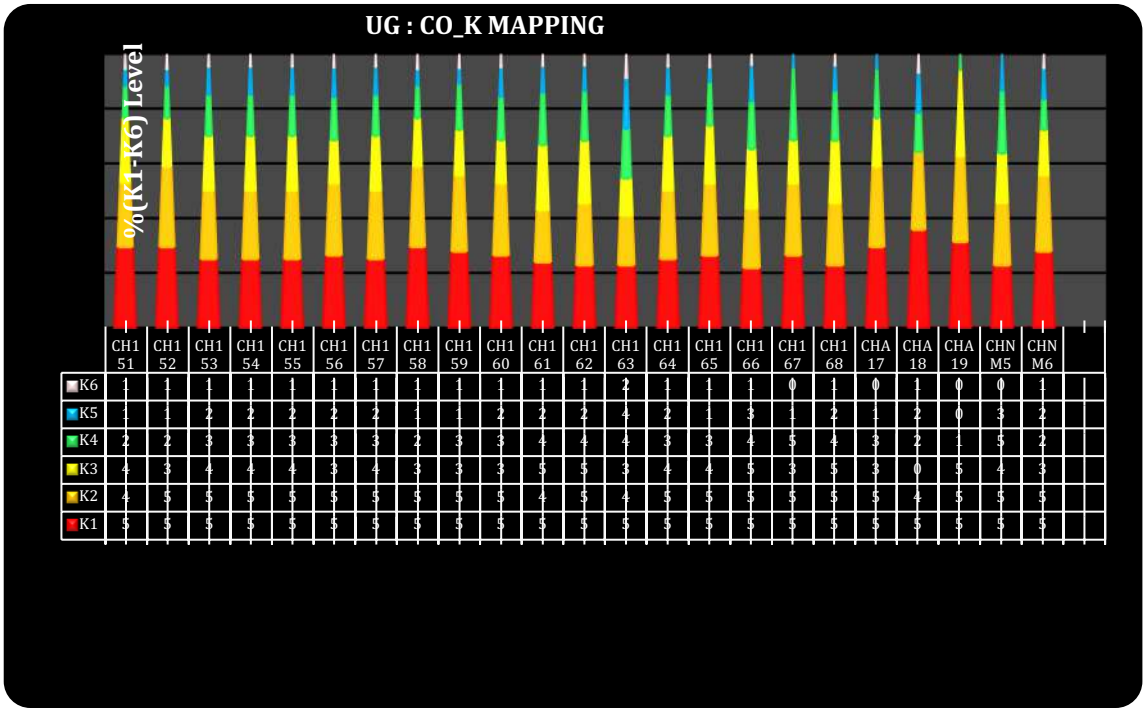
PO8. Ethical awareness / reasoning : Commitment to reinforce ethical and moral standards while practicing science by not resorting to manipulation, fabrication and plagiarism. Consciousness adherence to norms for copyright as well as intellectual property right. These attributes are instilled through courses on value education.

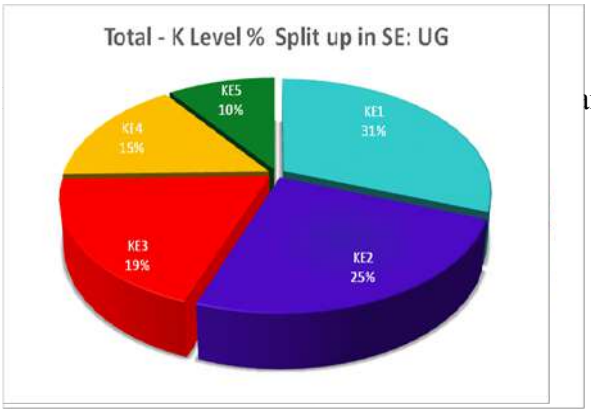
PO9. National and international perspective: Quest to stay updated about current developments in various concepts learnt during the course and in the field of research. Referring e Resources from institutions with national and international reputation, effective usage of INFLIBNET and participation in seminars ensures this attribute (**PSO7**).

PO10. Lifelong learners: Inclination to pursue a career in the field of chemistry makes students to continuously replenish their domain knowledge

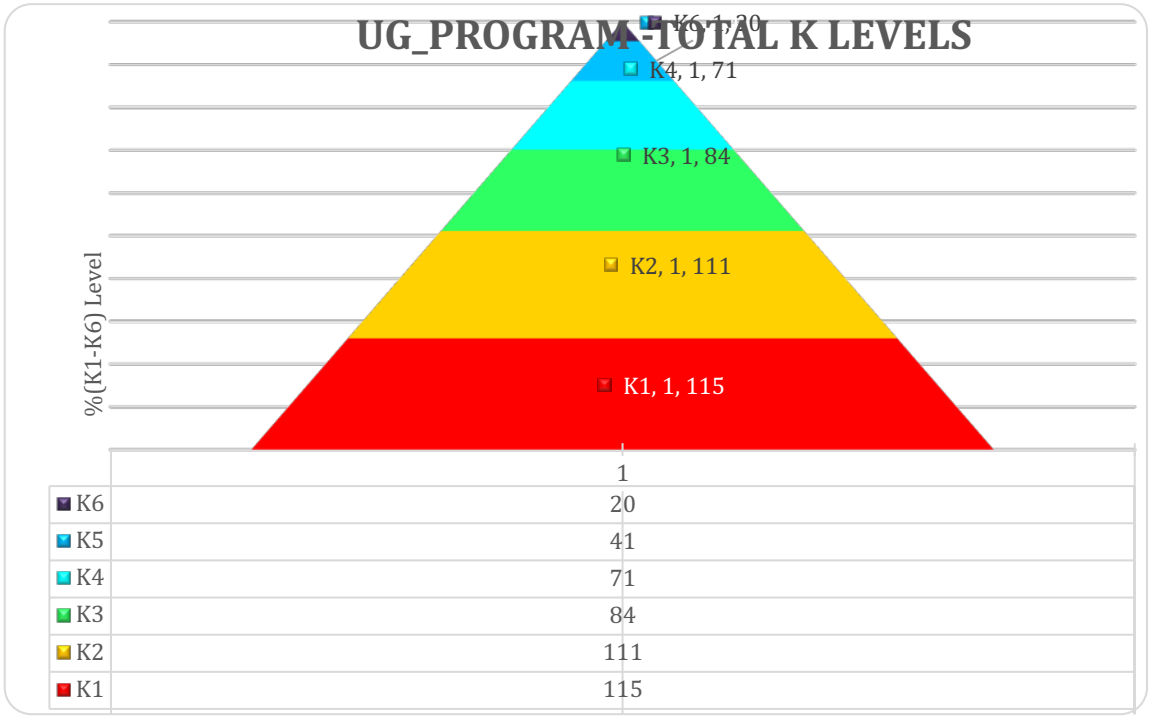
UG COURSE OUTCOME (CO)

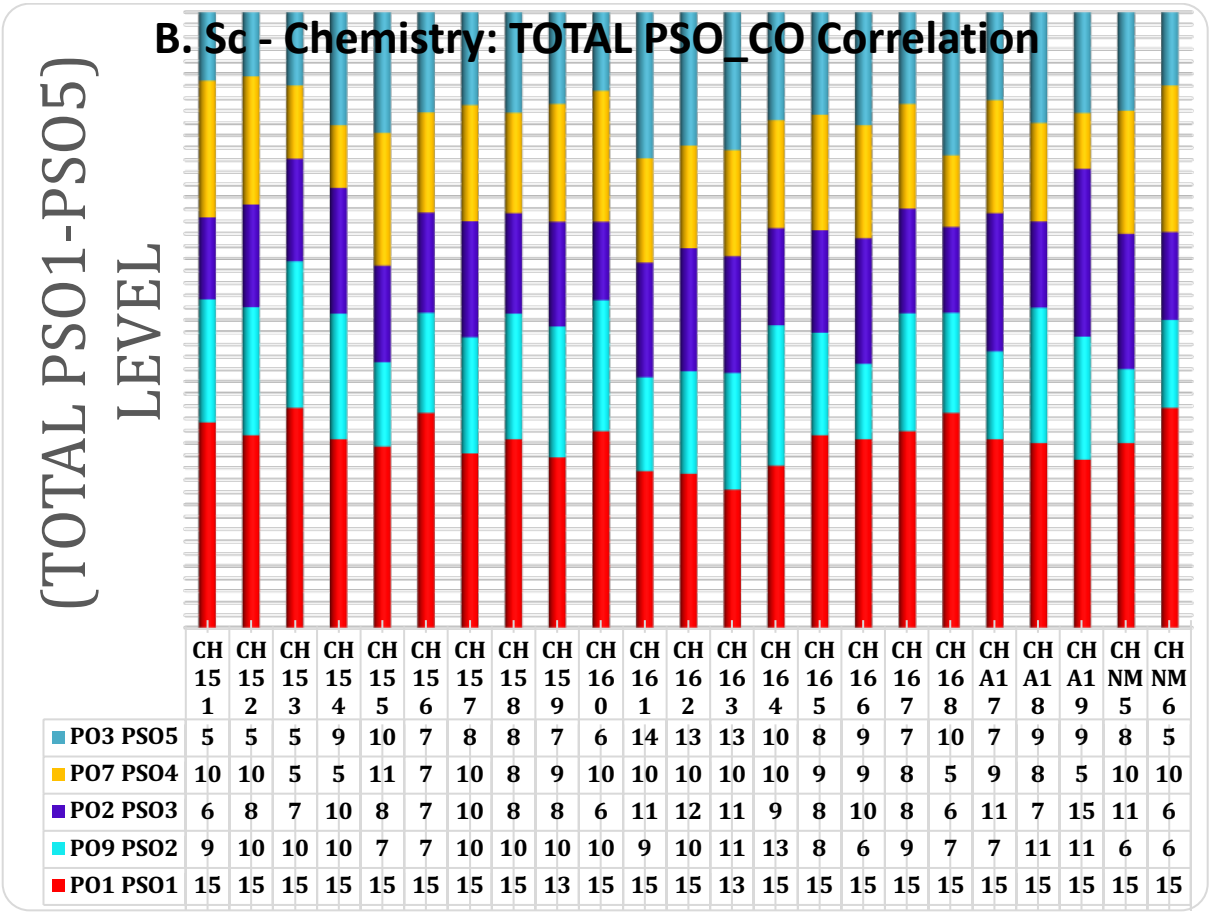
The UG Chemistry curriculum has been designed to fit into the ideologies of Bloom's taxonomy with strong knowledge level foundation, which enables the students to acquire clear understanding og basic concepts in Chemistry. Due weightage to creativity and critical thinking is given in internal assessment and end semester examination. The rational correlation of the course outcomes is evident in the evaluation pattern which is the strength of the course. Knowledge levels imparted in the curriculum are categorized based on Bloom's taxonomy under 6 levels as K1, K2, K3, K4, K5,K6 and are mapped to check their presence okr absence and are not scaled. In addition, employability of B.Sc Chemistry graduates is given due importance such that their core competency in the subject matter, both theoretical and practical is ensured

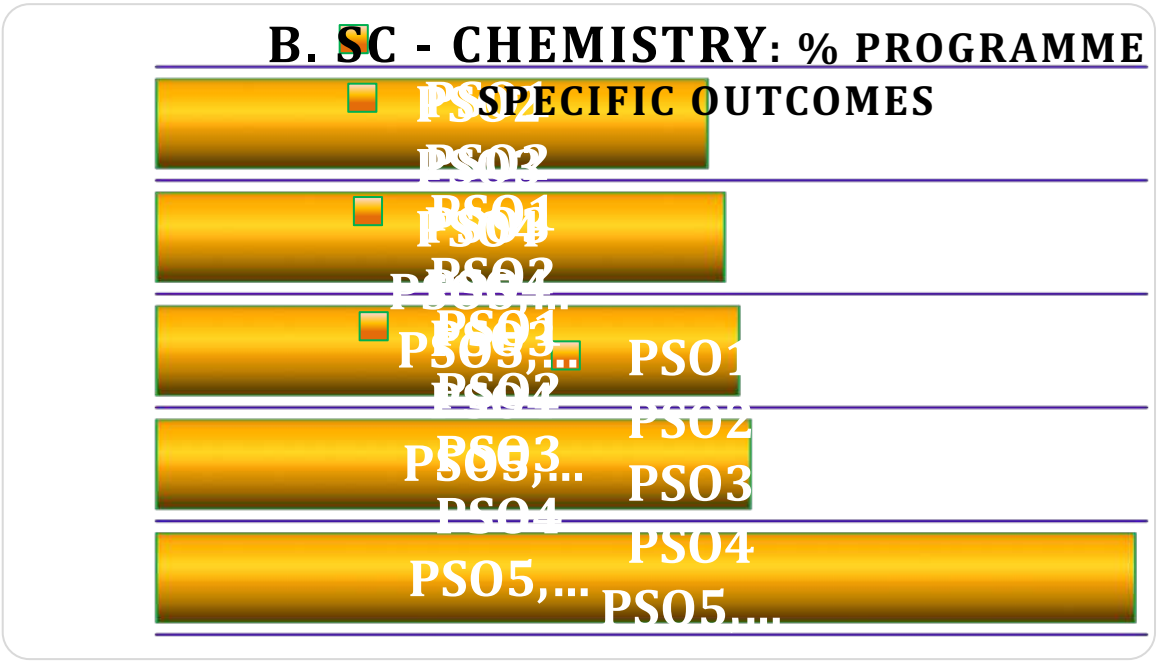


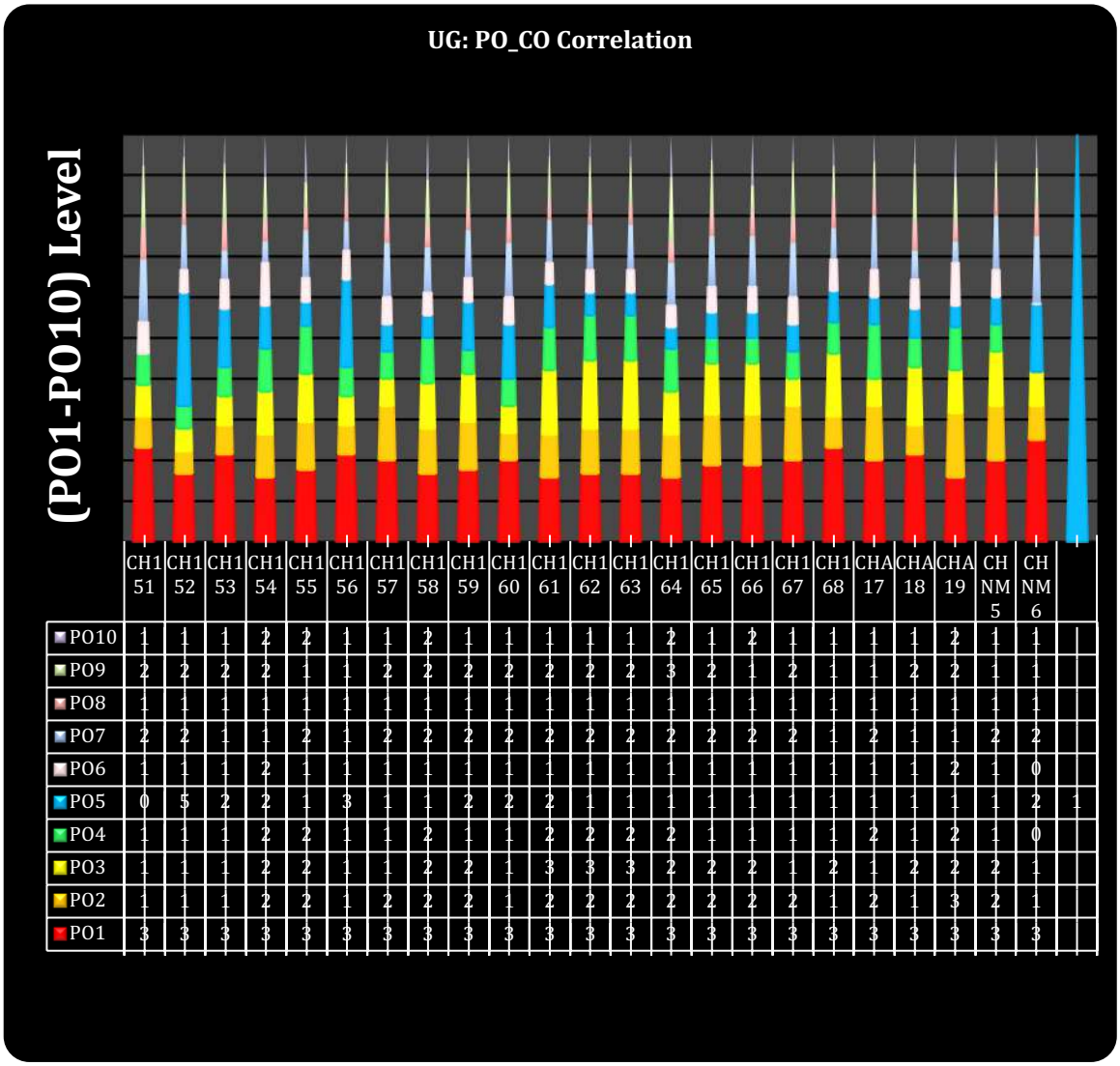


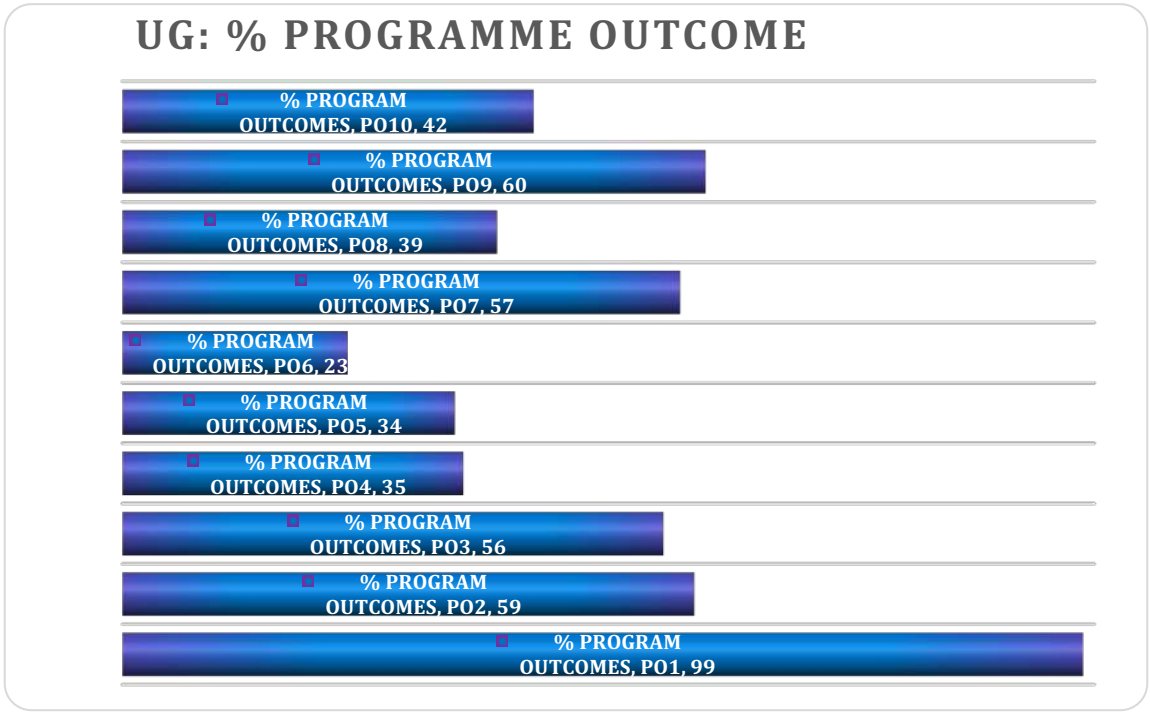
nd correlation details of all courses of the


UG_PROGRAM - TOTAL K LEVELS
K6, 1, 20
K4, 1, 71
K3, 1, 84
K2, 1, 111
K1, 1, 115
%(K1-K6) Level
1
K6 20
K5 41
K4 71
K3 84
K2 111
K1 115


B. Sc - Chemistry: TOTAL PSO_CO Correlation
(TOTAL PSO1-PSO5) LEVEL
CH151 CH152 CH153 CH154 CH155 CH156 CH157 CH158 CH159 CH160 CH161 CH162 CH163 CH164 CH165 CH166 CH167 CH168 CHA17 CHA18 CHA19 CHNM5 CHNM6
PO3 PSO5 5 5 5 9 10 7 8 8 7 6 14 13 13 10 8 9 7 10 7 9 9 8 5
PO7 PSO4 10 10 5 5 11 7 10 8 9 10 10 10 10 10 9 9 8 5 9 8 5 10 10
PO2 PSO3 6 8 7 10 8 7 10 8 8 6 11 12 11 9 8 10 8 6 11 7 15 11 6
PO9 PSO2 9 10 10 10 7 7 10 10 10 10 9 10 11 13 8 6 9 7 7 11 11 6 6
PO1 PSO1 15 15 15 15 15 15 15 15 13 15 15 15 13 15 15 15 15 15 15 15 15 15 15


B. SC - CHEMISTRY: % PROGRAMME
SPECIFIC OUTCOMES
PSO1
PSO2
PSO3
PSO4
PSO5,...


UG: PO_CO Correlation
(PO1-PO10) Level
CH151 CH152 CH153 CH154 CH155 CH156 CH157 CH158 CH159 CH160 CH161 CH162 CH163 CH164 CH165 CH166 CH167 CH168 CHA17 CHA18 CHA19 CHNM5 CHNM6
PO10 1 1 1 2 2 1 1 2 1 1 1 1 1 2 1 2 1 1 1 1 2 1 1
PO9 2 2 2 2 1 1 2 2 2 2 2 2 2 3 2 1 2 1 1 2 2 1 1
PO8 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
PO7 2 2 1 1 2 1 2 2 2 2 2 2 2 2 2 2 2 1 2 1 1 2 2
PO6 1 1 1 2 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 2 1 0
PO5 0 5 2 2 1 3 1 1 2 2 2 1 1 1 1 1 1 1 1 1 1 1 2 1
PO4 1 1 1 2 2 1 1 2 1 1 2 2 2 2 1 1 1 1 2 1 2 1 0
PO3 1 1 1 2 2 1 1 2 2 1 3 3 3 2 2 2 1 2 1 2 2 2 1
PO2 1 1 1 2 2 1 2 2 2 1 2 2 2 2 2 2 2 1 2 1 3 2 1
PO1 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3


UG: % PROGRAMME OUTCOME
% PROGRAM OUTCOMES, PO10, 42
% PROGRAM OUTCOMES, PO9, 60
% PROGRAM OUTCOMES, PO8, 39
% PROGRAM OUTCOMES, PO7, 57
% PROGRAM OUTCOMES, PO6, 23
% PROGRAM OUTCOMES, PO5, 34
% PROGRAM OUTCOMES, PO4, 35
% PROGRAM OUTCOMES, PO3, 56
% PROGRAM OUTCOMES, PO2, 59
% PROGRAM OUTCOMES, PO1, 99

QUEEN MARY'S COLLEGE (A), CHENNAI-4
B.Sc - CHEMISTRY

ANALYTICAL CHEMISTRY

SEMESTER I

Course No. : I **Max Marks: 75**
Code: **Credits: 5**

LEARNING OBJECTIVES

1. **To help the student to develop the habit of accurate manipulation and an attitude of critical thinking**
2. **To learn the basic analytical methods and appreciate what is involved in an analysis**

COURSE OUTLINE

Unit - I HANDLING OF CHEMICALS AND ANALYSIS

1.1 Safety and hygiene in the chemistry Laboratory:

Storage and handling of chemicals, handling of acids, ethers, toxic and poisonous chemicals, antidotes, threshold vapour concentration and first aid procedure. Calibration of pipette, standard measuring flask and burette. Weighing principle in chemical balance and single pan balance.

1.2 Error in chemical analysis

Accuracy, precision, Types of error-absolute and relative error, methods of eliminating or minimizing errors. Methods of expressing precision: mean, median, standard deviation, average deviation and coefficient of variation. Significant figures and its application with respect to the glassware used. Normal error curve and its importance.

UNIT - II SEPARATION AND PURIFICATION TECHNIQUES

2.1 General purification techniques

General experimental techniques- Heating methods, stirring methods and filtration techniques. Purification of solid organic compounds, recrystallisation, use of miscible solvents, use of drying agents and their properties, sublimation.

Purification of liquids. Experimental techniques of distillation, fractional distillation, distillation under reduced pressure. Extraction, use of immiscible solvents, solvent extraction.Chemical methods of purification and test of purity.

2.2 Chromatography Principle of adsorption and partition chromatography. Column chromatography: adsorbents, classification of adsorbents, solvents, preparation of column, adsorption and applications.

Thin Layer Chromatography: choice of adsorbent, choice of solvent, preparation of chromatogram, sample R_f value and its applications. Paper chromatography, solvent used R_f value, factors which affect R_f value. Ion exchange chromatography, resins used in chromatography, experimental techniques and applications.

Gas Chromatography, principle, detector (FID, TCD, ECD), Applications.

UNIT - III QUALITATIVE AND QUANTITATIVE ANALYSIS: SEMI MICRO AND GRAVIMETRIC ANALYSIS

3.1 Group Separation by Precipitation Techniques. Solubility and solubility products, expressions for solubility products. Determination of solubility from solubility products.

3.2 Laboratory methods in semi-micro qualitative analysis – Filtration of precipitates – washing of precipitates – heating and evaporation – transferring residue – methods of precipitating sulphides – types of reactions involved in qualitative analysis – spot test analysis – removal of interfering ions.

3.3 Gravimetric analysis - methods of obtaining the precipitate – conditions for precipitation – choice of precipitants – advantages and disadvantages of using organic precipitants – types of organic precipitants – specific and selective precipitants – sequestering agents .

3.4 Theories of precipitation – Co and Post precipitation – occlusion – surface adsorption – digestion – general rules for precipitation – types, care and uses of crucibles.

Unit - IV –Quantitative Analysis Titrimetric Method of Analysis

4.1 General Introduction

General principle: Types of titrations. Requirements for titrimetric analysis.

Concentration systems: Molarity, formality, normality, wt% ppm, milliequivalence and millimoles-problems. Primary and secondary standards, criteria for primary standards, preparation of standard solutions, standardization of solutions. Limitation of volumetric analysis, endpoint and equivalence point.

4.2 Acid-base equilibria and Neutralization titrations

pH of strong and weak acid solutions. Buffer solutions. Henderson equations. Preparation of acidic and basic buffers. Relative strength of acids and bases from K_a and K_b values. Neutralisation titration curve, theory of indicators, choice of indicators. Use of phenolphthalein and methyl orange.

4.3 Complexometric titrations

Stability of complexes, titration involving EDTA. Metal ion indicators and characteristics.

4.4 Precipitation titrations

Argentometric titrations, indicators for precipitation titrations involving silver. Determination of chloride by Volhard's method. Adsorption indicators.

Unit - V Thermal Analysis

5.1 Thermal analytical methods

Principle involved in thermogravimetric analysis and differential gravimetric analysis, discussion of various components with block diagram, characteristics of TGA and DTA, Factors affecting TGA and DTA curves.

TEXT BOOKS

1. D.A. Skoog, D.M. West and F. J. Holler, Analytical Chemistry: An Introduction, 5th edition, Saunders college publishing, Philadelphia, 1990.
2. U.N. Dash, Analytical Chemistry: Theory and Practice, Sultan Chand and sons. Educational Publishers, New Delhi, 1995.
3. R.A. Day Jr. A.L. Underwood, Quantitative analysis, 5th edition, Prentice Hall of India Private Ltd., New Delhi, 1988.
4. R. Gopalan, Analytical chemistry, S. Chand and Co., New Delhi.
5. Brian S Furniss, Antonny J Hannaford, Peter W G Smith, Austin R Tatchell, Vogel's Textbook of Practical Organic Chemistry, 5 edn., Pearson Education India, 2003.
6. Svehla / Sivasankar, Vogel's Qualitative Inorganic Analysis, 7th edn., Pearson Education India, 2012
7. J.Mendham, R.C. Denney, J.D. Barnes, M. Thomas and B. Sivasankar, Vogel's Quantitative Inorganic Chemical Analysis, 6th edn., Pearson Education India, 2009.

REFERENCE BOOKS

1. V.K. Srivastava, K.K. Srivastava, Introduction to Chromatography: Theory and Practice, S. Chand and Company, New Delhi, 1987.
2. R.M. Roberts, J.C. Gilbert, L.B. Rodewald, A.S. Wingrove, Modern Experimental Organic Chemistry, 4th edition, Holt Saunders International Editions.
3. A.K Srivastava, P.C. Jain, Chemical Analysis: An Instrumental Approach for B.Sc. Hons. and M.Sc. Classes, S. Chand and company Ltd., Ram Nagar, New Delhi.

WEB REFERENCES:

1. https://www.bu.edu/ehs/ehs-topics/chemical/safe-handling-and-storage-of-chemicals/
2. https://nptel.ac.in/content/storage2/courses/102103047/PDF/mod4.pdf
3. https://nptel.ac.in/courses/115/103/115103030/

QUEEN MARY'S COLLEGE (A), CHENNAI-4
B.Sc - CHEMISTRY
INORGANIC CHEMISTRY-I
SEMESTER –I

Course No. : II **Max Marks: 75**
Code: **Credits: 5**

LEARNING OBJECTIVES

To understand the nature, principles and theories involved in chemical bonding .

To know the existence of special types of compounds through chemical forces.

To gain thorough knowledge on the shape of atomic orbitals and quantum numbers.

To learn the general trends in periodic table with an emphasis on s- block elements

COURSE OUTLINE:

UNIT – I ATOMIC STRUCTURE

1.1 Bohr's atomic model:

Numerical values of radius and energy in Bohr's atom. Correction for the finite mass of the nucleus. Bohr's theory and spectral lines in hydrogen, ionization and resonance potential for hydrogen. Merits and demerits of Bohr's atomic model. Sommerfeld's atomic model - achievements and drawbacks.

1.2 Concept of spatial quantization:

Concept of the spinning electron, quantum numbers in the vector model. Four quantum numbers system and Pauli's exclusion principle. Coupling schemes and atomic states in the vector model. Spatial quantization of the resultant vectors (ie., L, S, J) in atoms or ions.

1.3 Determination of micro states and Russel – Saunders terms:

A simple working procedure to determine term symbols- Hund's rule to determine the ground state terms.

UNIT – II GENERAL TRENDS IN MODERN PERIODIC TABLE

2.1 Periodicity:

Periodic law and arrangement of elements in the periodic table, IUPAC nomenclature and group number, horizontal, vertical and diagonal relationships in the periodic table

2.2 General properties of atoms:

Size of atoms and ions-atomic radii, ionic radii, covalent radii, trends in ionic radii, ionization energy, ionization potential and electron affinity.

2.3 Electronegativity- Pauling, Mulliken-Jaffe, Allred-Rochow's scale, oxidation states and variable valency, isoelectronic relationship, inert-pair effect.

UNIT – III s- BLOCK ELEMENTS

3.1 Metals and their properties

Position of hydrogen in the periodic table. Factors influencing the formation of ionic compounds by s-block elements. Chemical properties of metals: reaction with water, air, nitrogen. Uses of s-block metals and their compounds.

3.2 Compounds and their properties

Compounds of s-block metals: oxides, hydroxides, peroxides, superoxides-preparation and properties:-Oxo-salts – carbonates, bicarbonates, nitrates, halides and polyhalides. Anomalous behaviour of Li and Be.

3.3 Complexes and their properties

Complexes of s-block metals: complexes with crown ethers, biological importance, organometallic compounds of Li and Be

UNIT – IV STRONG - IONIC AND WEAK – HYDROGEN BONDS

4.1 Ionic compounds-Properties of ionic compounds, factors favoring the formation of ionic compounds like ionization potential, electron affinity, and electronegativity.

4.2 Partial ionic character and its properties

Covalent character in ionic compounds-polarization and Fajan's rule, effects of polarization – solubility, melting point, and thermal stability of typical ionic compounds.

4.3 Weak bonds

Hydrogen bonding-intra- and inter molecular hydrogen bonding, influence on the physical properties of molecules, comparison of hydrogen bond strength and properties of hydrogen bonded N, O and F compounds, associated molecules-ethanol and acetic acid, Vander Waals force: dipole-dipole interactions and London forces.

UNIT – V COVALENT BOND

5.1 Theories and hybridisation

Lewis theory - Octet rule and its exemption, electron dot structural formula, Sidgwick-Powell theory- prediction of molecular shapes, Valence Bond theory – arrangement of electrons in molecules, hybridization of atomic orbitals and geometry of molecules.

5.2 VSEPR Theory

VSEPR model-effect of bonding and non-bonding electrons on the structure of molecules, effect of electronegativity, isoelectronic principle, illustration of structure by VSEPR model- NH_3, SF_4, ICl_4^-, ICl_2^-, XeF_4 and XeF_6.

5.3 Molecular Orbital Theory

MO Theory: LCAO method, criteria of orbital overlap, types of molecular orbitals – sigma (σ), and pi (π)-MOs, combination of atomic orbitals to give σ, and π-MOs and their schematic illustration, qualitative MO energy level diagram of homo and hetero diatomic molecules: hydrogen, helium, carbon, nitrogen, oxygen and fluorine. CO, NO, HCl, bond order and stability of molecules.

TEXT BOOKS

1. J. D. Lee, Concise Inorganic Chemistry, 5th ed., Blackwell Science, London, 1996.
2. Asim. K. Das, Fundamental Concepts of Inorganic Chemistry Volume-1, CBS Publisher 2010.
3. Asim. K. Das, Fundamental Concepts of Inorganic Chemistry Volume-2, CBS Publisher 2010.
4. R. D. Madan, Modern Inorganic Chemistry, S Chand,1987.
5. B. R. Puri, L. R.Sharma, K. C. Kalia, Principles of Inorg. Chem., S. Lal N. Chand 1996.
6. P. L. Soni, Mohan Katyal Textbook of Inorganic Chemistry, Sultan Chand & Sons.
7. Sathya Prakash, G. D. Tuli, Advanced Inorganic Chemistry volume-1, S Chand, 2000
8. Sathya Prakash, G. D. Tuli, Advanced Inorganic Chemistry volume-2, S Chand, 2000

REFERENCE BOOKS

1. J. E. Huheey, E. A. Kieter and R. L. Keiter, Inorg. Chem., 4th ed., Harper Collins, NY., 1993.
2. D. F. Shriver and D. W.Atkins, Inorg. Chemistry,3rd ed., W. H .Freeman and Co., London,1999
3. T. Moeller, Inorganic Chemistry: A Modern Introduction, Wiley, New York, 1990.
4. F. A. Cotton, G.Wilkinson and P. L.Guas, Basic Inorganic Chemistry, 3 Ed.,JW, 1994.

WEB REFERENCES:

1. https://www.slideshare.net/ShahnTee/different-atomic- models
2. https://www.slideshare.net/TannuSaini4/electronegativity-93707199
3. **https://www.slideshare.net/SaravanaKumar130/vsepr-theory-15122202**

QUEEN MARY'S COLLEGE (A), CHENNAI-4
B.Sc - CHEMISTRY
ORGANIC CHEMISTRY-I
Semester –II

Course No. : III **Max Marks: 75**
Code: **Credits: 5**

LEARNING OBJECTIVES

1. To understand and gain the basic knowledge on the classification and IUPAC nomenclature of organic compounds**.**
2. To study (i) hybridization and geometry of organic molecule and (ii) bonding and its influences
3. To learn the concepts of organic acids and bases and to study Electronic effects of organic molecule and its influences
4. To learn the preparation, properties and importance of aliphatic and alicyclic hydrocarbons.
5. To learn the preparation, properties and importance of alkenes and alkynes.

COURSE OUTLINE

Unit-I: Classification and Nomenclature **18 Hrs**

Classification of organic compounds - based on the nature of carbon skeleton and functional groups - classification of C and H atoms of organic compounds (primary/secondary/tertiary) - IUPAC system of nomenclature of common organic compounds (upto C-10) - alkanes, alkenes, alkynes, cycloalkanes, bicycloalkanes with and without bridges and aromatic compounds - Naming of organic compounds with one functional group - halogen compounds, alcohols, phenol, aldehydes, ketones, carboxylic acids and its derivatives, cyano compounds, amines, nitro compounds (Both aliphatic and aromatic) - Naming of compounds with two functional groups - naming of compounds with more than one carbon chain - Naming of heterocyclic compounds containing one and two hetero atoms present in five/six membered rings.

Unit-II: Bonding in Organic Molecules **18 Hrs**

Types of bonds: Ionic, Covalent and Coordinate bonds.

Hybridization and geometry: (sp^3/sp^2/sp) hybridization of carbon, oxygen and nitrogen containing compounds; bond angle, bond length, bond strength of C-H and C-C bonds – Polarity of bond and dipole moment. Hydrogen bond: Inter and Intra molecular hydrogen bonding; their effects on physical properties: boiling point, solubility in water and bond strength.van der waal's forces.

Dissociation of bonds: homolysis and heterolysis - electrophiles and nucleophiles.

Reactive intermediates: Generation, structure, stability and properties of radicals, carbocations, carbanions and carbenes.

Unit-III: Electronic Effects **18 Hrs**

Electronic effects: inductive effect; resonance effect: drawing of resonance structures - conditions for resonance - stability of resonance structures; hyperconjugation; electromeric effect; steric effect: steric overcrowding - steric inhibition of resonance - steric relief (with examples). Influence of electronic effects on dipole moment, relative strengths of acids and bases. Structural isomerism: types with examples – tautomerism – keto-enol, aci-nitro, amido-imido.

Unit-IV Alkanes and Alicyclic compounds **18 hrs**

Alkanes - preparations, physical properties, Reactions and Mechanism: halogenation, sulphonation, nitration, oxidation, cracking and aromatisation.

Alicyclic compounds: Preparation (small, medium & large ring compounds) - reactions - cycloaddition, dehalogenation, pyrolysis of calcium salt of dicarboxylic acid - Wurtz reaction - stability of cycloalkanes - Baeyer's strain theory. Cycloalkenes: Preparation and reactions of cycloalkenes - Preparation of conjugate dienes - reactions - 1,2 and 1,4 addition, polymerization and Diels-Alder reaction - Application in the synthesis of following molecules - trans 2-chlorocyclopentanol, trans-2 methylcyclopentanol, cis and trans 1,2 cyclohexanediol, cyclohexene, 2,3-butanedione and adipic acid.

Unit-V Alkenes and Alkynes **18 Hrs**

Alkenes: Preparation from alcohol, haloalkane, dihaloalkanes and alkynes - reactions of alkenes - mechanisms involved in addition of hydrogen, halogen, hydrogen halide, hypohalous acid, water, hydroboration, ozonolysis and epoxidation - peroxide effect - allylic substitution, oxidation by $KMnO_4$ and polymerization - Application in the synthesis of following molecules - Dibenzyl (from toluene), cis and trans 2-butene, propanal and 1-methyl cyclohexanol.

Akynes: Preparation, reactions - addition of hydrogen, halogen, hydrogen halide, water, HCN, CH_3COOH, hydroboration - dimerisation and cyclisation - acidity of terminal alkynes.

TEXT BOOKS

1. V. K. Ahluwalia, Organic Chemistry Fundamental Concepts, Narosa Publishing House 2012.
2. Maitland Jones , Henry L. Gingrich , Steven A. Fleming Organic Chemistry, 5th edn. W W Norton & Co Inc. 2014.

REFERENCE BOOKS

1. R. T. Morrison, R. N. Boyd and S.K.Bhattacharjee, Organic chemistry, 7th edn, Pearson Education Asia, 2016.
2. F. A. Carey and R. J. Sundberg, Advanced Organic Chemistry, Part A and B, 5th edn, Springer Publishers, 2010.
3. Arun Bahl and B.S. Bahl, A Text Book of Organic Chemistry, 22ndedn, S Chand & Company, 2016.
4. I. L. Finar, Organic Chemistry Vol-1& 2, 6thedn, Pearson Education Asia, 2004.
5. P. Y.Bruice, Organic Chemistry, Vol-1 & 2, 7th edn, Pearson Education Asia, 2013.
6. J.Clayden, N. Greeves, S. Warren, Organic Chemistry, 2nd edn, Oxford, 2012.
7. K. S. Tewari and N. K. Vishnoi, A Text Book of Organic Chemistry, 4th edition, Vikas Publishing House Pvt Ltd, 2017.
8. I. L. Finar, Organic Chemistry Vol-1& 2, 6th edn, Pearson Education Asia, 2004.
9. Bhupinder Mehta and Manju Mehta, Organic Chemistry, 2nd edition, PHI Learning Pvt Ltd, 2015.
10. M.K. Jain, S. C. Sharma and Amita, A Text book of Organic Chemistry, Vishal Publishing Co., 2019.
11. N. Tewari, Problems and Solutions: Advanced Organic Reaction Mechanism, 3rd Revised Edition, Books & Allied (P) Ltd, 2011.

WEB REFERENCES:

1. https://ncert.nic.in/ncerts/l/kech205.pdf
2. https://scilearn.sydney.edu.au/fychemistry/Lectures/Organic%20Nomenclature.pdf
3. 3.
4. https://elibrary.vssdcollege.ac.in/web/data/books-com-sc/mscpre/chemistry/organic%20Chemistry/Structure%20and%20Bonding.pdf
5. https://www.kau.edu.sa/Files/0009039/Subjects/05-Acid-base.pdf
6. http://polymer.zju.edu.cn/attachments/2013-09/01-1380550673-93936.pdf

7. http://padakshep.org/otp/subjects/chemistry/organic-chemistry/steric-electronic-effects/
8. https://www.adichemistry.com/organic/basics/inductive-effect/inductive-effect-1.html
9. http://epathshala.nic.in/wp-content/doc/book/flipbook/Class%20XI/11083ChemistryPart%20II/Unit-13/index.html#page=1
10. https://as.vanderbilt.edu/chemistry/Rizzo/chem220a/Chapter_5.pdf

QUEEN MARY'S COLLEGE (A), CHENNAI-4
B.Sc - CHEMISTRY

PRACTICAL I – VOLUMETRIC ANALYSIS

SEMESTER II

Course No. : IV **Max Marks: 75**
Code: **Credits: 5**

LEARNING OBJECTIVES

To enable the students to acquire knowledge and practical skill behind the volumetric analysis.

COURSE OUTLINE

1. Estimation of sodium hydroxide using standard Na_2CO_3
2. Estimation of borax using standard Na_2CO_3
3. Estimation of oxalic acid using Standard Ferrous sulphate
4. Estimation of FAS using standard Ferrous sulphate
5. Estimation of Fe^{2+} using internal indicator
6. Estimation of $K_2Cr_2O_7$ using standard $K_2Cr_2O_7$
7. Estimation of Cu using standard $K_2Cr_2O_7$
8. Estimation of Mg using EDTA
9. Estimation of Zn using EDTA
10. Estimation of hardness of water

REFERENCE BOOKS

1. Vogel's Textbook of Practical organic chemistry, 5th Ed., ELBS/Longman, England 1996.
2. V. Venkatesan, R. Veeraswamy, A. R. Kulandaivelu, basic principles of practical chemistry, S. Chand and Sons, 2004.

WEB REFERENCES:

1. https://youtu.be/sFpFCPTDv2w
2. https://youtu.be/ZXdQvM_lLN0
3. https://youtu.be/UlTmVWhBu3w

QUEEN MARY'S COLLEGE (A), CHENNAI-4
B.Sc - CHEMISTRY

ORGANIC CHEMISTRY – II

SEMESTER III

Course No. : V **Max Marks: 75**
Code: **Credits: 5**

LEARNING OBJECTIVES:

1.To know about aromaticity, aromatic electrophilic substitution and synthesis of s important aromatic compounds.

2.To study the preparation and chemical reactions of alkyl and aryl halides with mechanism and to
apply the knowledge in the synthesis of the compounds DDT and BHC.

3.To study the preparation and properties of alcohols and Phenols.

4.To study the preparation and properties of ethers and epoxides with mechanisms

5.To know the (i) Methods of synthesis of aldehydes and ketones (ii) Mechanism nucleophilic reactions and (iii) oxidation-reduction reactions.

COURSE OUTLINE

Unit – I: Aromatic Compounds **18 Hrs**

Aromaticity: definition - Huckel's rule - consequence of aromaticity - stabil carbon-carbon bond lengths in benzene ring, resonance energy.

Aromatic electrophilic substitution: General pattern of the mechanism involvin and π complexes, Energy profile diagrams, mechanism of nitration, halogenati sulphonation, mercuration and Friedel-Crafts reactions of benzene.

Effects of substituents on reactivity and orientation : Activating and deactivat substituents,Orientation in mono substituted benzenes.

Reactions of aromatic side chain: Halogenation and oxidation - Methods formation and chemical reactions of alkylbenzenes, biphenyl, naphthalene Anthracene - Synthesis of 3-nitrotoluene, 4-bromonitro benzene, bromoacetophenone, 3-(4-nitrophenyl)prop-1-ene, 3-nitrostyrene.

Unit-II: Haloalkanes and Haloarenes **18 Hrs**

Classification of alkyl halides - methods of formation from alcohols, alkanes, alkenes – allylic/ benzylic bromination and chlorination – Hundiecker reaction, Finkelstein reaction and Swart's reaction - nucleophilic substitution reactions - mechanisms of nucleophilic substitution reactions - S_N2 and S_N1 reactions with energy profile diagrams - dehydrohalogenation with mechanism - Saytzeff's rule - reaction with metals -Wurtz reaction and formation of Grignard reagent - Methods of formation of aryl halides - nucleophilc substitution reactions of aryl halides - addition-elimination and the elimination-addition mechanisms - electrophilic substitution -Ullmann reaction – Wurtz-Fittig reaction - Relative reactivities of alkyl, allyl, vinyl and aryl halides - Synthesis and uses of DDT and BHC.

Unit-III: Alcohols and Phenols **18 Hrs**

Preparation of alcohols through reduction, hydroboration, hydration, oxymercuration and Grignard reaction. Reactions of alcohol with mechanism: with metals, esterification, oxidation, dehydration, conversion to alkyl halides.

Preparation of phenols - acidity of phenol vs alcohols - relative acid strength of substituted phenols - reactions of phenols: esterification, oxidation, Kolbe's, Reimer-Tiemann, Gattermann, Preparation and properties of catechol, resorcinol and phloroglucinol.

Unit-IV: Ethers and Epoxides **18 Hrs**

Simple and mixed ethers: Preparation of aliphatic, aromatic and cyclic ethers by Williamsons's synthesis and alkoxy mercuration – demercuration and bimolecular dehydration of alcohols. Reaction : Cleavage by acids and oxidation to peroxides

Epoxides: Preparation and reactions of epoxide – Ring opening reactions by acid and base catalysts and organometallic reagents;

Unit-V: Aldehydes and Ketones **18 Hrs**

Common methods for the synthesis of aldehydes and ketones - synthesis of aldehydes from acid chlorides, Stephen's reduction - Gattermann-Koch and Etard reactions - synthesis of ketones from nitriles, dialkylcadmium, alkyl lithium and lithium dialkylcuprate and Friedel-Crafts and Hoesch reactions. Mechanism of nucleophillic additions to carbonyl group - addition of HCN, alcohols, thiols, sodium bisulfite, Grignard reagents -condensation with ammonia and its derivatives - Aldol, Perkin, Benzoin and Knoevenagel condensations, Wittig reaction, Mannich reaction, Reformatsky reaction and Cannizaro reaction. Oxidation by Tollen's reagent, $KMnO_4$,

hypohalite, Cr(VI), Mn(VII) reagents, SeO_2, peracids and DMSO with oxalyl chloride. Reduction by H_2/Ni, H_2-Pd-C, $NaBH_4$, $LiAlH_4$, MPV, DIBAL, Birch, Clemmensen and Wolff-Kishner reductions. α, β unsaturated aldehydes and Ketones – preparation and reactions.

TEXT BOOKS

1. R. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson India Ltd, 7th edn., 2016.
2. P. Y. Bruice, Organic Chemistry, 7th edn., Pearson Education India, 2013.
3. T. W. Graham Solomons, Organic Chemistry, 11th edition, Wiley, 2015.
4. V. K. Ahluwalia, Organic Chemistry Fundamental Concepts, Narosa Publishing House 2012.
5. Maitland Jones , Henry L. Gingrich , Steven A. Fleming Organic Chemistry, 5th edn. W W Norton & Co Inc. 2014.

REFERENCE BOOKS

1. K. S. Tewari and N. K. Vishnoi, A Text Book of Organic Chemistry, 4th edition, Vikas Publishing House Pvt Ltd, 2017.
2. I.L. Finar, Organic Chemistry Vol-1& 2, 6th edn., Pearson Education Asia, 2004.
3. Bhupinder Mehta and Manju Mehta, Organic Chemistry, 2nd edition, PHI Learning Pvt Ltd, 2015.
4. M.K. Jain, S. C. Sharma and Amita, A Text book of Organic Chemistry, Vishal Publishing Co., 2019.
5. N. Tewari, Problems and Solutions: Advanced Organic Reaction Mechanism, 3rd Revised Edition, Books & Allied (P) Ltd, 2011.
6. F A Carey and R J Sundberg, Advanced Organic Chemistry, Part A: Structure and Mechanisms, 5th edition, Springer, 2007.
7. Arun Bahl and B.S. Bahl, A Text Book of Organic Chemistry, 22ndedn, S Chand & Company, 2016.
8. I.L. Finar, Organic Chemistry Vol-1, 6th edn, Pearson Education Asia, 2002.
9. S.H.Pine – Organic Chemistry IV, Edition McGraw – Hill International Book Company, 1986

WEB REFERENCES:

1. https://www.sciencedirect.com/science/article/abs/pii/0264817288900037

2. https://www.masterorganicchemistry.com/2017/07/11/electrophilic-aromatic-substitution-introduction/
3. https://www.britannica.com/science/phenol
4. https://pubmed.ncbi.nlm.nih.gov/11282336/

QUEEN MARY'S COLLEGE (A), CHENNAI-4
B.Sc - CHEMISTRY

PHYSICAL CHEMISTRY – I

SEMESTER III

Course No. : VI **Max Marks: 75**
Code: **Credits: 5**

LEARNING OBJECTIVES

- To understand the concepts of thermodynamics, chemical kinetics and photochemistry.
- Apply the concepts to physical and chemical synthesis.

COURSE OUTLINE

UNIT – I FIRST LAW OF THERMODYNAMICS

1.1 Terminology of thermodynamics, Thermodynamic equilibrium, Extensive and intensive properties, Thermodynamic processes, First law of thermodynamics.

1.2 Internal energy, state functions, exact and inexact differentials, Enthalpy of a system, Heat capacity, relation between Cp and Cv , Expansion of ideal gas-Isothermal process: Change in internal energy, work done W(rev) and W(irrev) – Adiabatic process: work done, and enthalpy changes, comparison of isothermal and adiabatic expansion.

1.3 Application of the laws of thermodynamics to real gases: isothermal process – work done, change in internal energy, heat absorbed. Adiabatic process: Work done – Joule – Thomson effect -Joule –Thomson coefficient and its significance, inversion temperatures – Zeroth law of thermodynamics, Absolute temperature scale.

UNIT – II THERMOCHEMISTRY

2.1 Measurements of thermal changes – Heats of reaction – Calculation of change in internal energy from the enthalpy change, standard states and standard heat of formation.

2.2 Heat of combustion: integral heat of solution and dilution, heat of neutralization, heat of hydration, heat of transition,

2.3 Variation of enthalpy change of reaction with temperature (kirchoff"s equation), Flame and explosion temperatures, Hess's law and its application, Determination of calorific value using Bomb calorimeter, bond energy and heat of reaction.

UNIT – III SECOND LAW OF THERMODYNAMICS

3.1 Second law of thermodynamics – Need for second law – statements of Second law - Carnot theorem, Carnot cycle – Efficiency of heat engine.

3.2. Concept of entropy – State function – entropy change in isothermal expansion of ideal gas - Entropy change in reversible and irreversible process – Entropy change accompanying by change of phase – calculation of entropy change of an ideal gas with changes in pressure, volume and temperature – Entropy of mixing – Physical significance of entropy.

3.3. Gibbs free energy – Work function – Variation of free energy change with temperature and pressure – Maxwell's relationship – Criteria for spontaneity – Gibbs Helmholtz equation – Partial molar properties – ClapeyronClausius equation and its applications

UNIT-IV THIRD LAW OF THERMODYNAMICS

4.1Third Law of Thermodynamics- Nernst heat theorem – Planck and Lewis Randall formulation of third law. Absolute entropy of solids, liquids and gases. Evaluation of the standard entropy of oxygen, on the basis of heat capacity. Exceptions to third law of thermodynamics. Calculation of absolute entropies.

4.2 Partial Molar Properties- Chemical potential - Gibbs Duhem equation - effect of temperature and pressure on chemical potential - chemical potential in system of ideal gases - Duhem - Margules equation.

4.3 Concept of fugacity and activity- Determination of fugacity of gas - activity and activity coefficient.

UNIT-V CHEMICAL EQUILIBRIUM

5.1 Law of mass action. Various forms of equilibrium constants, Vant Hoff isotherm - derivation of thermodynamic equilibrium constant and its relationship with free energy changes under standard conditions. relationships between Kp and Kc. Vant Hoff isochore,

5.2 Application of law of mass action and Le-Chatelier-Braun principle to homogeneous gaseous reactions: dissociation of nitrogen tetroxide, formation of ammonia. Formation of HI and dissociation of PCl_5.

TEXT BOOKS

1. B. R. Puri and L. R. Sharma, Principles of Physical chemistry, Shoban Lal Nagin chand and Co. 33rd edition, 1992.
2. S. H. Maron and J.B Lando, Fundamentals of Physical Chemistry, Macmillan Limited, New York, 1966.
3. J. Rajaram and J.C. Kuriacose, Thermodynamics, Shoban Lal Nagin chand and Co. 2nd edition, 1993.
4. Bahl and ArunBahl -"Physical Chemistry"

REFERENCE BOOKS

1. P. W. Atkins, Physical Chemistry 7th edition, Oxford University press, 2001
2. S. K. Dogra and S., Dogra, Physical chemisty through Problems, New age international 4th edition 1996.
3. K. L. Kapoor, A text book of physical chemistry, volume 2 and 3, Macmillan, India Ltd, 1994.
4. Glasstone, Thermodynamics for Chemistry.
5. Glasstone, Physical Chemistry.

WEB REFERENCE

1. https://youtu.be/0OD0mOT-dKU
2. https://youtu.be/oVbSsjGh-UI
3. https://youtu.be/Y-fZxwZZkyI

QUEEN MARY'S COLLEGE (A), CHENNAI-4
B.Sc - CHEMISTRY

INORGANIC CHEMISTRY – II

SEMESTER - IV

Course No. : VII **Max Marks: 75**
Code: **Credits: 5**

LEARNING OBJECTIVES

- To acquire knowledge on the characteristics and applications of elements in the boron, carbon and nitrogen family.
- To understand the fundamental concepts of nuclear chemistry.
- To understand acid base chemistry and the role of non-aqueous solvents.

COURSE OUTLINE

UNIT – I BORON GROUP ELEMENTS

1.1 General characteristics of elements of Group III A –Physical and chemical properties of Boron compounds namely Borax, Boric acid, Boron nitride.

1.2 Classification of Boranes. Nomenclature of Boranes. Structure and molecular framework of boron hydrides. Synthesis and reactivity of boranes and carboranes. Wade's rule (polyhedral electron pair theory)

1.3 Aluminium- Physical and chemical, properties- uses -Al_2O_3, $AlCl_3$, alums – Alloys of aluminium.

UNIT – II CARBON GROUP ELEMENTS

2.1 General characteristics of elements of Group IV A – Allotropic forms of carbon – diamond, graphite and fullerene. Application of Carbon materials CNT, Graphene. Heteroatom substituted Graphene materials. Chemistry of oxides of carbon.

2.2 Preparation of Silicon – physical and chemical properties of Si – uses – oxides of silicon- uses.

2.2 Silicates – ortho, pyro, cyclic, chain, two dimensional, three dimensional silicates and their properties and structures of silicates. Alkali silicates: composition, properties and uses of: beryl, asbestos, talc, mica, zeolites and ultramarines.

UNIT – III NITROGEN GROUP ELEMENTS

3.1 General characteristics of elements of VA Group-Physical and chemical properties of nitrogen – uses – Chemistry of some nitrogen compounds: oxides, hydrazine, hydroxylamine, hydrazoic acid, nitric acid and its applications. Nitrogen cycle

3.2 Physical and chemical properties of phosphorus – uses – chemistry of PH_3, PCl_3, PCl_5, $POCl_3$, P_2O_5, oxyacids and oxoacids of phosphorous.

UNIT – IV PROTIC AND APROTIC SOLVENTS

4.1 Non-aqueous solvents: Classification of solvents – General properties of ionizing solvents-chemical reactions. liquid ammonia, liquid SO_2, liq. HF, liq. HCN, liq. BrF_3 and acetic acid as solvents.

4.2 Acid Base Chemistry: Theories of acids and bases: Arrhenius, Lowry- Bronsted theory- Solvent system, Lewis concept, Lux–Flood and Usanovich concept. HSAB principle and its applications.

UNIT – V NUCLEAR CHEMISTRY-I

5.1 The nucleus: subatomic particles, structure of the nucleus-shell model, liquid drop model; forces in the nucleus-mesons—stability of nucleus-n/p ratio, binding energy— radioactive elements.

5.2 Radiochemistry: natural and induced radioactivity— radioactive decay-〈-decay, ®-decay, ©-decay— neutron emission, positron emission, electron capture— unit of radioactivity(Curie) — half-life period— Geiger-Nuttal rule, radioactive displacement law, radioactive series.

5.3 Measurement of radioactivity: ionization chamber, Geiger- Muller counters, scintillation counters.

5. 4. Basic problems on binding energy and radioactivity.

TEXT BOOKS

1. J. D. Lee, Concise Inorganic Chemistry, 5th ed., Blackwell Science, London, 1996.
2. E. Huheey, E. A. Keiter and R. L. Keiter, Inorg. Chem., 4th ed., Harper Collins, NY., 1993.
3. H. J. Arnikar, Essentials of Nuclear Chemistry, New Age International Private Limited; 4 edition (1 January 2011).
4. Asim. K. Das, Fundamental Concepts of Inorganic Chemistry Volume-1, CBS Publisher 2010.
5. Asim. K. Das, Fundamental Concepts of Inorganic Chemistry Volume-2, CBS Publisher 2010.
6. Asim. K. Das, Fundamental Concepts of Inorganic Chemistry Volume-3, CBS Publisher 2010.

7. R. D. Madan, Modern Inorganic Chemistry, S Chand,1987.
8. B. R. Puri, L. R.Sharma, K. C. Kalia, Principles of Inorg. Chem., S. Lal N. Chand 1996.
9. P. L. Soni, Mohan Katyal Textbook of Inorganic Chemistry, Sultan Chand & Sons.
10. Sathya Prakash, G. D. Tuli, Advanced Inorganic Chemistry volume-1, S Chand, 2000
11. Sathya Prakash, G. D. Tuli, Advanced Inorganic Chemistry volume-2, S Chand, 2000

REFERENCE BOOKS

1. D. F. Shriver and D. W.Atkins, Inorg. Chemistry,3rd ed., W. H .Freeman and Co., London,1999
2. T. Moeller, Inorganic Chemistry: A Modern Introduction, Wiley, New York, 1990.
3. F. A. Cotton, G.Wilkinson and P. L.Guas, Basic Inorganic Chemistry, 3 Ed.,JW, 1994.

WEB REFERENCE

1. web.mit.edu/5.03/www/readings/polyhedral_boranes/out4.pdf ·
2. https://www.youtube.com/watch?v=lD9tvMhR_YI&list=PLj_Alq7xw30kiHotaWh9-rSKcGfX6gcC7&index=25,26,27,28,29,30,31

3 https://www.youtube.com/watch?v=NXlMupypM2E&list=PLj_Alq7xw30kiHotaWh9-rSKcGfX6gcC7&index=32-38

QUEEN MARY'S COLLEGE (A), CHENNAI-4
B.Sc - CHEMISTRY
PRACTICAL II -SEMIMICRO QUALITATIVE ANALYSIS
SEMESTER IV

Course No. : VIII **Max Marks: 75**
Code: **Credits: 5**

LEARNING OBJECTIVE

• To enable the student to develop analytical skills in inorganic qualitative analysis Semimicro qualitative analysis

COURSE OUTLINE

Qualitative analysis:

1. Training session for three classes:

Mixture of anions containing an interfering anion and its eliminating techniques. Mixture

of cations of simple radicals to familiarize with the inter group separation techniques

2. Semi micro qualitative analysis of inorganic salt mixtures containing one interfering acid radical.

3. Simple anions:

Carbonate, nitrate, sulphide, sulphite, sulphate, chloride and bromide

4. Interfering anions:

Borates, fluoride, oxalate, phosphate, arsenite and chromate.

5. Cations:

Group I cations: Lead, Silver, mercurous

Group II cations: Copper, cadmium, bismuth, antimony, tin, mercuric Group III cations: Aluminium, ferrous, ferric, chromium

Group IV cations: Cobalt, nickel, manganese, zinc

Group V cations: Barium, strontium, calcium

Group VI cations: Magnesium, ammonium

6. Preparation

Preparation of Ferrous Ammonium Sulphate, Microcosmic salt, Prussian blue and

Tetrammine copper II salt

REFERENCE BOOKS

1. V. V. Ramanujam, Inorganic semi micro qualitative analysis, 3rd edition, The National publishing company, Chennai, 1974.
2. Vogel's Text book of Inorganic qualitative analysis, 4th edition, ELBS. London, 1974.

WEB REFERENCE

1. https://www.youtube.com/watch?v=FdVO1zX6doA (Courtasy)

2.https://www.youtube.com/watch?v=0B_Mq5uY9Ng (Courtasy)

3.https://www.youtube.com/watch?v=7cuJSQYVOzM (Courtasy)

4. https://pubs.acs.org/doi/abs/10.1021/ac50149a006

QUEEN MARY'S COLLEGE (A), CHENNAI-4
B.Sc - CHEMISTRY
ORGANIC CHEMISTRY - III
SEMESTER - V

Course No. : IX **Max Marks: 75**
Code: **Credits: 5**

LEARNING OBJECTIVES : The target of the course is to impart

1. knowledge about preparation and properties of carboxylic acids
2. synthetic applications of active methylene compounds
3. characteristics of amines
4. awareness about importance of natural products
5. understanding of stereochemistry of organic compounds

COURSE OUTLINE

Unit-I: Carboxylic Acids and Their Functional Derivatives 18 hrs

Carboxylic acids: Preparation, acidity, effects of substituents on acid strength, acidity of aliphatic vs aromatic acids. Reactions of carboxylic acids - Hell-Volhard-Zelinsky reaction, Reduction of carboxylic acids, methods and mechanism of decarboxylation.

Carboxylic acid derivatives: Preparation and reactivity of acid chlorides, esters, amides and anhydrides - Mechanisms of esterification and hydrolysis (acid and base catalysed reactions) – transesterification. Relative stability of acyl derivatives - interconversion of acid derivatives by nucleophilic acyl substitution.

Substituted acids: Preparation and chemical reactions of a) halo acids b) Hydroxy acids - malic, tartaric and citric acids.

Unsaturated monocarboxylic acids: acrylic acid, crotonic acid and cinnamic acid.

Unit–II: Dicarboxylic Acids and Active Methylene Compounds 18hrs

Dicarboxylic acids: Preparation and properties of dicarboxylic acids oxalic, malonic, succinic, adipic and phthalic acids.

Active methylene compounds: Malonic and acetoacetic esters: Preparation, characteristic reactions of active methylene group, synthetic uses of malonic, acetoacetic and cynaoacetic ester.

Diazomethane and diazoacetic ester: Preparation, properties, structure and synthetic applications.

Unit-III: Nitrogen Containing Compounds **18 hrs**

Preparation of nitroalkanes and nitroarenes - Chemical reactions of nitroalkanes and nitroarenes - reductions in acidic, neutral and alkaline media. Methods of preparation of alkyl and aryl amines - Gabriel phthalimide reaction and Hofmann reaction - separation of a mixture of primary, secondary and tertiary amines - Hinsberg's and Hofmann's method - Structural features effecting basicity of amines - basicity of aliphatic and aromatic amines - reactions of amines. Aryl diazonium salts - preparation, stability, reactions and synthetic transformations. Amino acids - essential and nonessential - methods of preparation - zwitterions formation - isoelectric point - chemical reactions of amino acid.

Unit-IV: Natural Products **18 hrs**

Alkaloids: Definition - classification with suitable examples for each class - properties - structural determination - Sources, isolation, physiological activities and structure of piperine, conine, nicotine.

Terpenoids: Definition, isoprene rule and classification with suitable examples - Isolation, properties, structure and uses of citral, geraniol and camphor.

Unit-V: Stereochemistry-I **18 hrs**

Structural isomerism - types with examples – tautomerism – keto-enol, nitro-acinitro, amido-imido. Stereochemistry - Representation of molecules in saw horse, Fischer, flying-wedge and Newman formulae and their inter translations. Symmetry elements - chirality – asymmetric molecules and molecular dissymmetry-pseudo asymmetry. Geometrical isomerism – nomenclature of geometrical isomers – cis/trans, E-Z notation and syn-anti for C=C,C=N compounds - Methods to assign configurations - Stability of geometrical isomers and heats of hydrogenation. Optical rotation – specific rotation -optical purity - methods of racemization - Optical isomers - enantiomers - diastereomers – epimers - notation of optical isomers - Cahn-Ingold-Prelog rules, R and S notations for optical isomers with one and two asymmetric carbon atoms - erythro and threo representations - D and L representations.

TEXT BOOKS

1. P.S.Kalsi, Stereochemistry – Conformation and Mechanism, New age international, 10th edn. 2019.
2. P. Y. Bruice, Organic Chemistry, 8th edn., Pearson Education India, 2017.
3. V. K. Ahluwalia, Organic Chemistry Fundamental Concepts, Narosa Publishing House 2012.

4. Maitland Jones , Henry L. Gingrich , Steven A. Fleming Organic Chemistry, 5th edn. W W Norton & Co. Inc. 2014.

REFERENCE BOOKS

1. R. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson India Ltd, 7th edn., 2016.
2. I. L. Finar, Organic Chemistry Vol. 1, 6th edn, Pearson Education Asia, 2004.
3. Ernest L. Eliel, Samuel H. Wilen, and Lewis N. Mander, Stereochemistry of Organic Compounds, New York: Wiley, 2008.
4. F A Carey and R J Sundberg, Advanced Organic Chemistry, Part A: Structure and Mechanisms, 5th edn., Springer, 2007.
5. Arun Bahl and B.S. Bahl, A Text Book of Organic Chemistry, 22nd edn, S Chand & Company, 2016.
6. P. Y. Bruice, Organic Chemistry, 8thedn, Pearson Education India, 2017.
7. J. Clayden, N. Greeves, S. Warren, Organic Chemistry, 2nd edn, Oxford, 2012.
8. Gurdeep Chatwal, Organic Chemistry of Natural Products Vol-I & II, Himalaya Publishing House. First edition Reprint 2004.
9. D. Nasipuri, Stereochemistry of Organic Compounds – Principles and Applications, 3rd edn., New age international, 2012.
10. G. Marc Loudan, Organic Chemistry, 5th edition, Roberts & co., 2009.

WEB REFERENCE

1.https://mpsasc.edu.in/storage/app/application/SemActive%20Methylene%20Compounds.pdf

2.https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/Questions/Acidity/basestr1.htm

3. https://nptel.ac.in/content/storage2/courses/104103071/pdf/mod8.pdf

QUEEN MARY'S COLLEGE (A), CHENNAI-4
B.Sc - CHEMISTRY
INORGANIC CHEMISTRY III
SEMESTER V

Paper No. : X **Max Marks: 75**
Code: **Credits: 5**

LEARNING OBJECTIVES

1. To gain thorough knowledge on the characteristics and applications of elements oxygen, halogen and noble gas family in the periodic table.
2. To gain the knowledge on the unique features of transition and rare earth elements and its importance.
3. Students attain in depth knowledge of nuclear reactions and their applications.

COURSE OUTLINE

UNIT – I OXYGEN GROUP ELEMENTS 18 Hrs

1.0. Anomalous behavior of oxygen – Structure, preparation , properties and uses and allotropes of oxygen: di, tri, tetra oxygen .

1.1. Preparation, properties and reactions of following Oxides - peroxides, suboxides, basic oxides, amphoteric oxides, acidic oxides and neutral oxides

1.2. Oxides of Sulphur –Preparation properties and uses of sulphur sesquioxide, sulphur di oxide, sulphur trioxide and sulphur heptoxide.

1.3. Oxoacids of sulphur – preparation, properties and uses of sulphuric acid, oleum, sulphurous acid, hyposulphurous acid, peroxy sulphuric acids, Dithionic acid and polythionic acids.

1.4. Sulfuryl compounds – Preparation properties and uses of sulfuryl chloride, sulfuryl fluoride and sulphones.

1.5. Chemistry of Selenium and Tellurium- Occurrence- preparation , properties and uses.

UNIT – II HALOGEN FAMILY AND NOBLE GASES 18 Hrs

2.1 General characteristics of halogen family with reference to electro negativity, electron affinity, oxidation states, and oxidizing power – anomalous behaviour of fluorine. Hydrides, oxides and oxo acids of halogens.

2.2 Interhalogen compounds – polyhalide ions – pseudohalogens – preparation, properties and structure of interhalogen compounds of the type AX, AX_3, AX_5 and AX_7 .

2.3 Inert gases – position in the periodic table – General characteristics – Structure and shape of Xenon compounds – XeF_4, XeF_6, $XeOF_2$ & $XeOF_4$ – uses of noble gases.

UNIT – III TRANSITION ELEMENTS **18 Hrs**

1.1 Chemistry of transition elements – electronic configuration – group study of titanium, vanadium, chromium, manganese and iron metals – comparative study of zinc group metals – Important uses of transition metals and their alloys.

1.2 Horizontal comparison of Fe, Co and Ni – toxicity of Cd and Hg – synthesis and reactivity of chromates, dichromate, molybdates, tungsten bronzes, manganate, permanganate. Interstitial compounds – nitrides, carbides, hydrides, borides of Ti, V, Cr, W, and their industrial uses.

UNIT – IV LANTHANIDES AND ACTINIDES **18 hrs**

4.1 Lanthanides: lanthanide series, abundance and natural isotopes, lanthanide contraction, similarity in properties, occurrence, oxidation states, chemical properties of Ln(III) cations, magnetic properties, colour and electronic spectra of lanthanide compounds.

4.2 Separation of lanthanides: solvent extraction, ion exchange method.

4.3 Actinides: actinide series, abundance and natural isotopes, occurrence, preparation of actinides, oxidation states, general properties, the later actinide elements. Uranium-extraction, properties and uses. Complexes of lanthanides and actinides-nature of formation.

UNIT- V NUCLEAR CHEMISTRY-II **18 hrs**

5.1 Nuclear reactions: types of nuclear reactions, nuclear cross section, spallation, nuclear fission-theory of nuclear fission, nuclear fusion, chain reaction, critical mass. Nuclear reactors and breeder reactors- components and its working principle with diagram. Nuclear reactors in India.

5.2 Separation of isotopes: Electromagnetic method, Diffusion method, Fractional distillation and Electrolytic method. Applications of radioactive isotopes.

TEXT BOOKS

1. J. D. Lee, Concise Inorganic Chemistry, 5th ed., Blackwell Science, London, 1996.

2. E. Huheey, E. A. Kieter and R. L. Keiter, Inorg. Chem., 4th ed., Harper Collins, NY., 1993.
3. H. J. Arnikar, Essentials of Nuclear Chemistry, New Age International Private Limited; 4 edition (1 January 2011).
4. Asim. K. Das, Fundamental Concepts of Inorganic Chemistry Volume-1, CBS Publisher 2010.
5. Asim. K. Das, Fundamental Concepts of Inorganic Chemistry Volume-3, CBS Publisher 2010.
6. Asim. K. Das, Fundamental Concepts of Inorganic Chemistry Volume-4, CBS Publisher 2010.
7. R. D. Madan, Modern Inorganic Chemistry, S Chand,1987.
8. B. R. Puri, L. R.Sharma, K. C. Kalia, Principles of Inorg. Chem., S. Lal N. Chand 1996.
9. P. L. Soni, Mohan Katyal Textbook of Inorganic Chemistry, Sultan Chand & Sons.
10. Sathya Prakash, G. D. Tuli, Advanced Inorganic Chemistry volume-1, S Chand, 2000
11. Sathya Prakash, G. D. Tuli, Advanced Inorganic Chemistry volume-2, S Chand, 2000
12. F. Purcell, C. Kotz, Inorganic Chemistry, Cengage Publisher, 2010.
13. R. Gopalan, V. Ramalingam, Coordination Chemistry, Vikas Publication House Pvt Ltd; First edition (2008).
14. Madan, Malik, Tuli, Selected Topics in Inorganic Chemistry, S Chand (1 November 2010).

REFERENCE BOOKS

1. D. F. Shriver and D. W.Atkins, Inorg. Chemistry,3rd ed., W. H .Freeman and Co., London,1999
2. T. Moeller, Inorganic Chemistry: A Modern Introduction, Wiley, New York, 1990.
3. F. A. Cotton, G.Wilkinson and P. L.Guas, Basic Inorganic Chemistry, 3 Ed.,JW, 1994.

WEB REFERENCE

1. https://www.britannica.com/science/halogen
2. https://nptel.ac.in/courses/115/102/115102017/
3. https://chem.libretexts.org/Bookshelves/Introductory_Chemistry/Book%3A_Introductory_Chemistry_(CK-12)/06%3A_The_Periodic_Table/6.14%3A_Lanthanides_and_Actinides

QUEEN MARY'S COLLEGE (A), CHENNAI-4
B.Sc - CHEMISTRY
PHYSICAL CHEMISTRY II
SEMESTER V

Paper No. : XI **Max Marks: 75**
Code: **Credits: 5**

LEARNING OBJECTIVES:

To enable the students to

- learn about electrolytic conductance and ionic mobility
- gain knowledge on electrodes, electrode potential and EMF
- understand the basic principles and applications of electrochemical cells
- learn the basic concepts of chemical kinetics and rate equation
- acquire insight into the theories of chemical kinetics and calculate the reaction rate.

COURSE OUTLINE:

UNIT –I ELECTROCHEMISTRY - I 18 hrs

1.1 Electrolytic conductance - specific, equivalent, molar conductance, cell constant, variation of equivalent conductance with concentration. Ionic mobility - migration of ions - Kohlrausch's law and its application.

1.2 Transport number, Hittorf's rule- Determination of transport number. Applications of conductance measurements – Conductometric titrations. Ostwald's dilution law.

1.3 Debye-Huckel theory of strong electrolytes – the concept of ionic atmosphere, asymmetry and electrophoretic effect. Debye-Huckel-Onsager equation (no derivation). Activity, activity coefficient and mean ionic activity coefficients of electrolytes. Ionic strength of a solution, Debye-Huckel limiting law (no derivation).

UNIT- II ELECTROCHEMISTRY-II 18 hrs

2.1 Electrochemical cells and Electrolytic cells, Galvanic cells, - Representation of cells. Electrode potential: Single and standard electrode potentials. Reference electrodes: Standard Hydrogen Electrode and Saturated Calomel Electrode - Electrochemical Series - Significance. Determination of standard electrode potentials of zinc and copper electrodes.

2.2 Different types of reversible electrodes: Metal-metal ion electrodes, Amalgam electrodes, Gas Electrodes, Metal insoluble salt electrodes, Redox electrodes.

2.3 Electro Motive Force: Definition and measurement using a potentiometer, Construction and working of Weston Cadmium Standard cell. Conventions regarding sign of EMF.

UNIT –III ELECTROCHEMISTRY-III 18 hrs

3.1 Thermodynamics of electrochemical reactions. Derivation of Nernst equation for electrode potential. Relationship between EMF and free energy changes, enthalpy changes, entropy changes occurring in electrochemical reactions. Equilibrium constant for electrochemical reactions.

3.2 Concentration cells – Electrode concentration cell and electrolyte concentration cells. Derivation of EMF of Electrolyte concentration cells with and without transference. Liquid junction potential and salt bridge - Applications of EMF - pH determination using hydrogen, quinhydrone and glass electrodes.

3.3 Commercial cells: Dry cell, lead acid accumulator, alkali cell and H_2 - O_2 fuel cells. Introduction to chemical sensors and biosensors.

UNIT – IV CHEMICAL KINETICS 18 hrs

4.1 Definition – Rate, order, rate law, rate constants. Simple reactions involving zero, first, second and third order reactions. Derivation of rate equations for zero, first and second order reactions. Pseudo-first – order reactions. Study of kinetics of pseudo-first-order reactions – acid and base catalyzed hydrolysis of ester and inversion of cane sugar.

4.2 Determinations of rate, rate constant and order by different methods. Simple mechanisms and molecularity of reactions.

UNIT – V TYPES AND THEORIES OF CHEMICAL REACTION RATES 18 hrs

5.1 Reversible or opposing, consecutive and parallel reactions (no derivation expected). Thermal chain reactions. (i) H_2 and Br_2 reaction (ii) Dissociation of acetaldehyde. (Steps involved only)

5.2 Factors affecting chemical reactions – nature of reactants, concentration, catalyst, solvent polarity and ionic strength (only qualitative ideas). Arrhenius theory of chemical reaction rates. Collision theory of bimolecular and unimolecular reactions. Lindemann hypothesis. Transition state theory or absolute reaction rate theory (ARRT).

TEXT BOOKS

1. B. R. Puri, L. R. Sharma, M.S. Pathania, Principles of Physical chemistry, Vishal Publications, 44th Edn, 2010.
2. K. L. Kapoor, A textbook of Physical Chemistry, Volume 2 and 3, Macmillan India Ltd, 2000.
3. P.L.Soni, O.P. Dharmarha, U.N.Dash, Textbook of Physical Chemistry, Sultan Chand & Co., Revised 2016.
4. Arun Bahl, B.S. Bahl, G.D. Tuli, Essentials of Physical Chemistry, S. Chand & Co, 5th Edn, 2014.

REFERENCE BOOKS

1. P. W. Atkins, Physical Chemistry 7th edition, Oxford University press, 2001
2. S. Glasstone, Introduction to Electrochemistry, East-West Press Pvt. Ltd., Revised 2014.
3. S. K. Dogra and S., Dogra, Physical chemistry through Problems, New age international 4th edition 1996.
4. Gurdeep Raj, Advanced Physical Chemistry, Goel Publishing House, 34th Edn, 2014.
5. S. H. Maron and J.B Lando, Fundamentals of Physical Chemistry, Macmillan Limited, New York, 1966.
6. K.J. Laidler, Chemical Kinetics, Pearson Education Pvt. Ltd., 3rd Edn, 2007.
7. W.J. Moore, Physical Chemistry, Longman Publications, 5th Edn, 1999 Reprint.

WEB REFERENCES

1. http://nptel.ac.in
2. https://myelcass.academy
3. http://epathshala.ncert.org.in
4. http://www.slideshare.net

QUEEN MARY'S COLLEGE (A), CHENNAI-4
B.Sc - CHEMISTRY
ELECTIVE – I-A
FUNDAMENTALS OF SPECTROSCOPY
SEMESTER V

Course No. : XII **Max Marks: 75**
Code: **Credits: 5**

LEARNING OBJECTIVES

- The target of the course is,
- To understand how EMR interacts with matter and the various possible applications because of the interactions.
- To understand the basic concepts involved in Microwave, IR, Raman, UV, NMR and Mass spectroscopic techniques and their instrumentation and applications.
- To enable students derive structures of compounds from spectroscopic data

COURSE OUTLINE

UNIT –I INTRODUCTION TO SPECTROSCOPY 12 hrs

1.1 Interaction of low energy radiation with matter: Electromagnetic spectrum, quantization of energy, Electronic, vibrational and rotational energy levels, and transitions in atoms and molecules. Absorption and emission spectra. Statement of Born Oppenheimer approximation, degrees of freedom.

1.2 Boltzmann distribution (formula only). Relative population of translational, rotational, vibrational and electronic energy levels at different temperatures.

1.3 Transition probabilities, selection rules, line widths, resolution and signal to noise ratio.

UNIT – II MICROWAVE, IR AND RAMAN SPECTROSCOPY 24 hrs

2.1 Diatomic molecules- Energy levels of a rigid rotor(semi-classical principles)-selection rules-determination of bond length-qualitative description of non-rigid rotor- isotope effect- microwave spectroscopy- instrumentation- structure of OCS.

2.2 Principle, selection rule- types of stretching and bending vibrations, vibrational frequencies, instrumentation, block diagram, source, monochromator, cell sampling techniques, detector and recorders, identification of organic molecules from characteristic absorption bands. Elementary problems involving only IR data.

2.3 Raman spectroscopy, Rayleigh and Raman scattering, Stoke's and Antistoke's line, instrumentation, block diagram, differences between IR and Raman spectroscopy, mutual exclusion principle, applications, structural diagnosis

UNIT –III ELECTRONIC SPECTROSCOPY 18 hrs

3.1 Absorption laws, calculations involving Beer – Lambert's Law, verification and its limitations.

3.2 Instrumentation of photo colorimeter and spectrophotometer, block diagrams with description of components, theory, types of electronic transitions, chromophores and auxochromes, absorption bands and intensity, factors governing absorption maximum and intensity.

3.3 Atomic absorption spectroscopy and Flame photometry – principles, instrumentation and applications.

UNIT – IV NMR SPECTROSCOPY 18 hrs

4.1 Principle of nuclear magnetic resonance, basic instrumentation, shielding mechanism, chemical shift, number of signals, spin-spin coupling and coupling constants, splitting of signals, deuterium labelling.

4.2 Applications of NMR to simple organic compounds- ethanol, Chloropropane, Benzyl chloride.

UNIT – V MASS SPECTROSCOPY 18 hrs

5.1 Basic principles of mass spectrum, molecular peak, base peak, isotopic peak, metastable peak and their uses.

5.2 Instrumentation: Recognition of molecular ion peak and isotopic peaks- confirmation of recognized molecular ion peak- ring rule. Nitrogen rule.

5.3 Applications- determination of molecular mass- molecular formula.

5.4 General fragmentation modes- fragmentation of hydrocarbons- aliphatic, aromatic alkenes- hydroxy compounds- phenols- aldehydes-ketones- carboxylic acids.

TEXT BOOKS

1. Colin N. Banwell and Elain M. McCash, Fundamentals of Molecular spectroscopy, McGraw Hill Education; Fourth edition (1 July 2017)
2. Y.R. Sharma, Elementary Organic Spectroscopy, S Chand; Fifth edition (1 January 2013)
3. Lampman, Pavia, Kriz, Vyvyan, Introduction to Spectroscopy, Cengage Learning India Private Limited; 5 edition (14 January 2015)
4. LDS Yadav, Organic Spectroscopy, Springer; 2004 edition (30 August 2013)

5. R. Gopalan, Analytical Chemistry, S. Chand and Co., New Delhi.

REFERENCE BOOKS

1. D. A. Skoog, D. M. West and F. J. Holler, Analytical Chemistry: An Introduction, 5th edition, Saunders college publishing, Philadelphia, 1990.
2. U. N. Dash, Analytical Chemistry: Theory and Practice, Sultan Chand and sons Educational Publishers, New Delhi, 1995.
3. R. A. Day Jr. and A. L. Underwood, Quantitative Analysis, 5th edition, Prentice Hall of India Private Ltd., New Delhi, 1988.
4. Y.R. Sharma, Elementary Organic Spectroscopy: Principles and Chemical Applications, S.Chand and company Ltd., Ram Nagar, New Delhi, 1990.
5. V. K. Srivastava and K.K. Srivastava, Introduction to Chromatography: Theory and Practice, S.Chand and company, New Delhi, 1987.
6. R. M. Roberts, J. C. Gilbert, L. B. Rodewald, and A. S. Wingrove, Modern Experimental Organic Chemistry, 4th edition, Holt Saunders international editions.
7. A.K. Srivastava and P.C. Jain, Chemical Analysis: An Instrumental Approach for B.Sc. Hons. and M.Sc. Classes, S.Chand and Company Ltd., Ram Nagar, New Delhi.
8. S. M. Khopkar, Basic concept of Analytical Chemistry, 2nd edition, New Age International Publishers, New Delhi, 1998.

WEB REFERENCE

1. https://nptel.ac.in/content/storage2/courses/104106083/tutorial12forweek7/lec1.pdf
2. https://www.digimat.in/nptel/courses/video/104108078/L01.html
3. https://nptel.ac.in/content/storage2/courses/102101007/downloads/PPT/LEC-20 PPT.pdf
4. http://www1.lasalle.edu/~price/202%20mass%20spec%20problem%20set-13.pdf

QUEEN MARY'S COLLEGE (A), CHENNAI-4
B.Sc - CHEMISTRY
ELECTIVE –I-B
POLYMER CHEMISTRY
SEMESTER= V

Course No. : XIII **Max Marks: 75**
Code: **Credits: 5**

LEARNING OBJECTIVES

- **To introduce the types of polymers and polymerization**
- **To make them understand the synthesis and processing of polymers**
- **To interpret applications of plastics and rubbers in various fields based on their properties.**

COURSE OUTLINE

UNIT – I: INTRODUCTION OF POLYMERS (18 Hrs)

1.1 Basic definition, Degree of polymerization, Nomenclature of polymers – Home, Hetero, Block and Graft Copolymers, Functionality of polymers - Linear, Branched and Cross-linked polymers, Classification of polymers - Natural and Synthetic polymers, Organic and Inorganic polymers, Thermoplastic and Thermosetting polymers.

1.2 Preparation and industrial applications of Polyethylene, Polyvinyl chloride, Teflon, Nylon6,6 and Bakelite.

1.3 Elastomers – Natural rubber, Vulcanization, Synthetic rubber – Styrene Butadiene rubber and Neoprene.

UNIT – II: TYPES AND TECHNIQUES OF POLYMERIZATION (18 Hrs)

2.1 Types of polymerization – Addition, Condensation and Copolymerization. Mechanism of polymerization - Free radical, ionic and Zeigler-Natta polymerization. Kinetics of free radical polymerization.

2.2 Techniques of polymerization - Bulk, Solution, Suspension and Emulsion polymerization.

2.3 Separation techniques for polymer – Gel permeation chromatography.

UNIT–III: PROPERTIES AND MOLECULAR WEIGHT DISTRIBUTION OF POLYMERS: (18 Hrs)

3.1 Amorphous and crystalline polymers, Tacticity of polymers, Glass transition temperature (Tg) and its determination. Free volume theory, WLF equation, Factors affecting Tg.

3.2 Number average and weight average molecular weights. Determination of absolute molecular weight of polymers by Viscometry, Osmometry and Light scattering methods.

UNIT – IV: POLYMER ADDITIVES AND FABRICATION OF POLYMERS (18 Hrs)

4.1 Introduction to Plastic additives with examples and their function – fillers, plasticizers and softeners, Lubricants and flow promoters, Anti aging additives, Flame retardants, Colourants, Blowing agents, Cross linking agents, Heat & Photo stabilizers.

4.2 Fabrication – Compression, Injection, Transfer and Extrusion.

UNIT – V: SPECIALITY POLYMERS (18 Hrs)

Conducting polymers - its classification – Conduction in polyacetylene – applications.

Biodegradable polymers – factors responsible for biodegradation – characteristics – properties and applications of Poly Hydroxy Butarate –hydroxy Valarate (PHBV).

Electroluminescent polymers – polyphenylene-vinylene (PPV) as Polymer LED.

Liquid Crystal Polymers – classification – Kevlar – properties and applications.

Polymer composites – Fiber Reinforced Plastics (FRP) - constituents, types, properties and applications.

TEXT BOOKS

1. Gowariker, V.R., N.V.Viswanathan, Jayadev sreedhat, Polymer science, /Newdelhi : new age international, 2004.
2. Billmeyer, F.W. Text book of Polymer Science, Wiley Interscience, 2006.
3. Seymour, R.B. & Carraher, C E., Polymer Chemistry: An Introduction, Marcel Dekker, Inc. New York, 1981.
4. Odian, G. Principles of Polymerization, 4th Ed., Wiley 2004.
5. Arora and Singh, Polymer chemistry, Anmol Publications, 2002.
6. P. Bahadur and N.V. Sastry, Text book of polymer science, Alpha Science International, 2005.

REFERENCE BOOKS

1. Ghosh, P. Polymer Science and Technology, Tata Mc-Graw hill Education, 1991.
2. Bhatnagar, MS., Textbook of polymers, New Delhi, S Chand, 2004.

WEB REFERENCE

1. https://nptel.ac.in/courses/103103139
2. https://nptel.ac.in/courses/113105077
3. https://onlinecourses.nptel.ac.in/noc21_ch49/preview

QUEEN MARY'S COLLEGE (A), CHENNAI-4
B.Sc - CHEMISTRY
ELECTIVE –I-C
PHARMACEUTICAL CHEMISTRY
SEMESTER-V

Course No. : XIV **Max Marks: 75**
Code: **Credits: 5**

LEARNING OBJECTIVES

- **To introduce the mechanism of action of various drugs**
- **To distinguish antiseptics and disinfectants**
- **To make them understand the therapeutic uses of antibacterials and antibiotics**
- **To interpret the therapeutic applications of Narcotic and non-narcotic analgesics.**

COURSE OUTLINE

UNIT-I: INTRODUCTION TO DRUGS (18 Hrs)

1.1 Basic definition and terminologies: Pharmacophore, Pharmacology, Pharmacognosy, Pharmacodynamics, Bacteria, Virus & Fungi, Metabolites & Antimetabolites – Naming of drugs – Storage of drugs, Biological classification of drugs, Therapeutic index, ED_{50}, LD_{50}.

1.2 Mechanism of drug action, The chemistry of drug-receptor binding, Mechanism of different types of drug action, Absorption of drugs, Different routes of administration of drugs.

UNIT – II: COMMON DIESEASES AND THEIR TREATMENT METHODS (18 Hrs)

2.1 Common diseases- causes, symptoms, mode of transmission, treatment and prevention, Insect borne diseases (malaria, filaria, plague, dengue). Water borne diseases (typhoid, jaundice, cholera). Air borne diseases (flu, diphtheria, common cold, mumps, measles, tuberculosis).

2.2 Diabetes- Types, Symptoms and Control

2.3 Cancer – Causes and Treatment methods – Anticancer – oncology – DNA intercalation agents.

2.4 AIDS- Causes, Prevention and Treatment

2.5 Anaemia – Causes and Control

UNIT–III: ANTIBACTERIALS, ANTIBIOTICS, ANTISEPTICS AND DISINFECTANTS (18 Hrs)

3.1 Antibacterials: Sulpha drugs – mechanism of action – preparation and therapeutic uses of Sulphadiazine, Sulphapyridine, Sulphathiazole, Sulphafurazole and Prontosil.

3.2 Antibiotics: Definition and classification – Structure, Properties and Therapeutic uses of Chloramphenicol, Penicillin, Streptomycin, Tetracycline and Erythromycin – SAR of Chloramphenicol only.

3.3 Antiseptics and disinfectants – Definition and distinction – phenolic compounds, chloro compounds and cationic surfactants.

UNIT–IV: ANALGESICS, ANTIPYRETICS & ANTI-INFLAMMATORY AGENTS (18 Hrs)

4.1 Analgesics: Definition and action - Classification – Narcotic analgesics: Morphine and its derivatives – SAR of morphine-Synthetic Narcotic analgesics: Pethidine and Methadone.

4.2 Non-Narcotic/ Anti-inflammatory analgesics – Salicylic acid derivatives, Para aminophenol derivatives, Pyrazole derivatives, Indolyl and aryl acetic acid derivatives.

4.3 Drugs affecting CNS – Definition, distinction and examples for tranquilizers, sedatives and hypnotics. Psychedelic drugs – LSD, Marihuana and their effects.

UNIT – V: ANAESTHETICS & CARDIOVASCULAR DRUGS (18 Hrs)

5.1 Anaesthetics: Definition and requisites – Local and General – Volatile: Nitrous oxide, Ether, Chloroform, Cyclopropane – uses and disadvantages. Non-volatile/ Intravenous: Thiopental sodium, Methohexitone, Propandid. Local: the esters and the amides.

5.2 Cardiovascular drugs: Cardiotonic drugs: Cardiac Glycosides, Antiarrythmic drugs, Anti Anginal agents & Vasodilators – Definition, Structure and Uses of any two drugs under each.

5.3 Blood: Grouping- Composition – Rh factor, Blood pressure, hypertension and hypotension – causes and control.

TEXT BOOKS

1. Lakshmi, S., Pharmaceutical Chemistry, Sultan Chand & Sons, 3rd Ed., 2004.
2. Jayashree Ghosh., Fundamental concepts of applied chemistry, 1st Ed., S.Chand, 2006.
3. Patrick, G.L., An Introduction to Medicinal Chemistry, 4thEd., Oxford University Press, 2009.

REFERENCE BOOKS

1. Jayashree Ghosh., A Text Book of Pharmaceutical Chemistry, 3rd Ed., S. Chand, 2003.
2. Nogrady, T., & Weaver, D.F., Medicinal Chemistry-A molecular and biochemical approach, Oxford University press, 2005.
3. Ghosh, P. Polymer Science and Technology, Tata Mc-Graw hill Education, 1991.
4. Bhatnagar, MS., Textbook of polymers, New Delhi, S Chand, 2004.

WEB REFERENCE

1. https://www.people.vcu.edu/~urdesai/Lectures/CardiovascularDrugs.pdf
2. https://www.unodc.org/pdf/publications/report_2003-09-01_1.pdf
3. https://www.youtube.com/watch?v=_X1M_KzAy8M

QUEEN MARY'S COLLEGE (A), CHENNAI-4
B.Sc - CHEMISTRY
PRACTICAL –III
PHYSICAL CHEMISTRY EXPERIMENTS AND ORGANIC PREPARATION
SEMESTER VI

Course No. : XV **Max Marks: 75**
Code: **Credits: 5**

LEARNING OBJECTIVES

- Target of the course is to impart the basic principles of physical properties using various instrumental
- techniques, promote the basic procedural skills and competencies of the students throwing
- a deeper understanding of the scientific concepts and principles.

COURSE OUTLINE

Paper I

Physical Chemistry experiments: (4hrs)

1. Determination of rate constant of acid catalysed hydrolysis of ester.
2. Determination of rate constant of iodination of acetone
3. Determination of rate constant for the reaction between potassium iodide and potassium persulphate.
4. Determination of C. S. T. of phenol water system.
5. Determination of effect of impurity on C.S.T. of phenol water system.
6. Determination of molecular weight by Rast method.
7. Determination of transition temperature of salt hydrates.
8. Determination of partition coefficient for the distribution of I_2 between H_2O and CCl_4.
9. Determination of equivalent conductance of a strong electrolyte.
10. Determination of strength of acid/base by conductometric titration.

Paper II

Preparation and recrystallisation of organic compounds (2 hrs)

1. Bromination
2. Benzoylation
3. Hydrolysis
4. Oxidation
5. Nitration

QUEEN MARY'S COLLEGE (A), CHENNAI-4
B.Sc - CHEMISTRY
ORGANIC CHEMISTRY - IV
SEMESTER VI

Course No. : XVI **Max Marks: 75**
Code: **Credits: 5**

LEARNING OBJECTIVES

The target of the course is to impart knowledge of the following topics to the students,

1. To understand about rearrangement reactions and its synthetic applications.
2. To know the synthetic strategies and terminologies involved in organic synthesis and the role of important reagents in organic synthesis.
3. To understand clearly about the classification and structural features of carbohydrates.
4. To study about the basic concepts, characteristic features, preparation and reaction of heterocyclic compounds.
5. To understand about stereochemistry, symmetry elements, optical activity and conformational analysis of acyclic and cyclic compounds.

COURSE OUTLINE

UNIT-I: REARRANGEMENTS **18 hrs**

Rearrangement to electron-deficient carbon: 1,2 shift (Wagner-Meerwein rearrangement, pinacol rearrangement, dienone-phenol; Wolff rearrangement, benzil-benzilic acid rearrangement). Aromatic rearrangements from oxygen to ring carbon: Fries, Claisen and benzidine rearrangement. Rearrangement to electron-deficient nitrogen: Beckmann, Schmidt, Hofmann, Lossen, Curtius rearrangement. Rearrangement to electron-deficient oxygen: Baeyer-Villiger oxidation, hydroperoxide rearrangement, cumenehydroperoxide-phenol rearrangement, Dakin reaction.

Unit-II: SYNTHETIC METHODOLOGY **18 hrs**

Synthetic terminology: Disconnection, synthon, synthetic equivalent (SE), Functional group interconversion (FGI), Target molecule (TM); retro synthetic analysis: Linear, Convergent and Combinatorial synthesis. Retrosynthesis of organic mono functional compounds: Alcohols, aldehydes, ketones, carboxylic acids – and bifunctional compounds (1,2 and 1,3 only) via disconnection approach- Uses of protective groups, activating groups and bridging elements.

Unit-III: CARBOHYDRATES **18 hrs**

Carbohydrates: Definition - Classification with suitable examples - Classification of sugars as reducing and non-reducing sugars - Anomers and epimers with suitable examples - Monosaccharides: Classification of monosaccharides with suitable examples – Glucose - properties of glucose - Epimerization of glucose - Anomers of glucose and mutarotation - Fructose and its properties - Conversion glucose into fructose and vice-versa - Formation of osazone and glycosides - Fischer open structure and evidences for open structure - Haworth projection cyclic structures (pyranose and furanose) and evidences for cyclic structures of glucose and fructose - Stepping up - Kiliani- Fischer synthesis and stepping down - Ruff degradation of monosaccharides - Disaccharides: α – and β – glucosidic linkages with suitable examples - 1,4' and 1,6' linkages with suitable examples - Structure and properties of sucrose- Polysaccharides: Cellulose, combination of cellulose - Starches structure of amylose and glycogen.

UNIT-IV: HETEROCYCLIC COMPOUNDS **18 hrs**

Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine - Comparison between basicity of pyridine, piperidine and pyrrole - Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution and mechanism of nucleophilic substitution reaction in pyridine derivatives.

Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis; mechanism of electrophilic substitution reactions of indole, quinoline and isoquinoline.

UNIT-V: STEREOCHEMISTRY-II **18 hrs**

Optical activity in compounds without asymmetric carbon atoms namely biphenyls, allenes and spiranes, Stereo selectivity, stereo specificity - asymmetric synthesis. Conformational Analysis - Conformation - Conformational nomenclature: eclipsed, staggered, gauche and anti; dihedral angle, torsion angle, energy barrier of rotation - potential energy diagram. Relative stability of conformers on the basis of steric effect, dipole-dipole interaction, H-bonding - Conformational analysis of ethane, propane, *n*-butane, haloethane, 1,2-dihaloethane, 1,2-glycol and 1,2-halohydrin, cyclopentane, cyclohexane and mono substituted cyclohexanes.

TEXT BOOKS

1. P. Y. Bruice, Organic Chemistry, 8th edn., Pearson Education India, 2017.
2. V. K. Ahluwalia, Organic Chemistry Fundamental Concepts, Narosa Publishing House 2012.
3. Maitland Jones , Henry L. Gingrich , Steven A. Fleming Organic Chemistry, 5th edn. W W Norton & Co. Inc. 2014.
4. P.S.Kalsi, Stereochemistry – Conformation and Mechanism, New age international, 10th edn 2019.

REFERENCE BOOKS

1. R. T. Morrison and R. N. Boyd, Organic Chemistry, Pearson India Ltd, 7th edn., 2016.
2. I. L. Finar, Organic Chemistry Vol. 1, 6th edn, Pearson Education India, 2004.
3. F A Carey and R J Sundberg, Advanced Organic Chemistry, Part A: Structure and Mechanisms, 5th edn., Springer, 2007.
4. Arun Bahl and B.S. Bahl, A TextBook of Organic Chemistry, 22nd edn, S Chand & Company, 2016.
5. P. Y. Bruice, Organic Chemistry, 8th edn, Pearson Education India, 2017.
6. J. Clayden, N. Greeves, S. Warren, Organic Chemistry, 2nd edn, Oxford, 2012.
7. G. Marc Loudan, Organic Chemistry, 5th edition, Roberts & co., 2009.
8. Paul Wyatt, Stuart Warren, Organic synthesis – Strategy and Control, John Wiley and Sons, Ltd. 2007
9. Stuart Warren and Paul Wyatt, Workbook for Organic Synthesis: The Disconnection Approach, 2nd edn., 2010.
10. Stuart Warren and Paul Wyatt, Organic Synthesis: The Disconnection Approach, 2nd edn., 2009.
11. Ernest L. Eliel, Samuel H. Wilen, and Lewis N. Mander, Stereochemistry of Organic Compounds, New York: Wiley, 2008.
12. D. Nasipuri, Stereochemistry of Organic Compounds – Principles and Applications, 3rd edn., New age international, 2012.

WEB REFERENCE

1. https://byjus.com/chemistry/organic-rearrangement-

reaction/#:~:text=What%20is%20rearrangement%20reaction%20with,isobutane%20and%20pentane%20to%20isopentane.
2 . https://www.sciencedirect.com/topics/chemistry/stevens-rearrangement
3. https://nptel.ac.in/courses/104/105/104105087/
4. https://nptel.ac.in/content/storage2/courses/104103071/pdf/mod8.pdf

QUEEN MARY'S COLLEGE (A), CHENNAI-4
B.Sc - CHEMISTRY
INORGANIC CHEMISTRY – IV
SEMESTER VI

Course No. : XVII **Max Marks: 75**
Code: **Credits: 5**

LEARNING OBJECTIVES:

- To develop an understanding on the fundamental concepts of coordination complexes and also about their formation, stability and reaction mechanisms involved.
- To enable students understand the vital role of various catalysts.
- Another objective of this unit is to help the students understand the development and uses of bioinorganic compounds.
- This unit is also designed to enable students to make sense of bonding in organometallic compounds and photochemistry of organometallic compounds.

COURSE OUTLINE

UNIT – I COORDINATION CHEMISTRY 18 hrs

1.1 IUPAC nomenclature - theories of coordination compounds -Werner, Sidgwick, Valence bond, Crystal Field theory.

1.2 Crystal field splitting in octahedral, tetrahedral and square planar fields – factors influencing the magnitude of crystal field splitting – CFSE in weak and strong fields– calculations– pairing energy. Jahn-Teller distortion.

1.3 Magnetism and Colour: Orbital and spin magnetic moments, spin only moments of d^n ions and their correlation with effective magnetic moments, including orbital contribution; quenching of magnetic moment.

UNIT – II MO THEORY AND CATALYSIS 18 hrs

2.1 Molecular Orbital theory: Formation sigma, pi bonding in the Oh, Td and Sp Complexes. Oxidative addition, reductive elimination and insertion reactions.

2.2 General principles of catalysis, basic reactions involved in catalysis by organo metallic compounds. Hydrogenation of olefins by Wilkinson's catalyst, oxo-process. Monsanto acetic acid synthesis, Palladium catalysed oxidation of olefins (Wacker's process), Zeigler-Natta catalyst.

UNIT – III STABILITY AND REACTION MECHANISM OF COMPLEXES

18 hrs

3.1 Stability of complexes - factors affecting the stability of complexes. Kinetic versus thermodynamic stability. Experimental determination of stability constant and composition of complexes.

3.2 Determination of configuration of cis- and trans- isomers by chemical methods. Labile and inert complexes, substitution reactions in tetrahedral and square planar complexes– trans effect.

3.3 Reaction mechanisms – substitution reactions in octahedral complexes – S_N1 and S_N2 mechanisms, acid hydrolysis. Mechanism of one electron transfer reactions: inner sphere and outer sphere mechanisms. Two electron transfer reactions, Complementary and non- complementary reactions.

UNIT – IV ORGANOMETALLIC CHEMISTRY- I 18 hrs

4.1 Introduction - Definition - criteria for formation of organo metallic compounds, nomenclature, 18 and 16 electron rule.

4.2 Type of carbonyls, Coordinating behaviour of the carbonyls. Characteristic features of the terminal and bridging CO. Factors favouring bridged and non-bridged CO. Fluxionality in carbonyls, synergistic effect.

4.3 Preparation, properties, hybridization and geometry of mono and poly nuclear carbonyls of Cr, Mn, Fe, Co and Ni. Evidences in favour of π-back bonding. Effect of π- back bonding on the magnitude of 10Dq in the isoelectronic and isostructural carbonyls.

UNIT –V BIOINORGANIC CHEMISTRY 18 hrs

5.1 Metal ion in biology and their vital role in the active site. Ion transport mechanism in cell membrane – Na^+ and K^+ pumps- Ionophores – Structures, Biological functions and characteristic features of Hemoglobin and myoglobin – Vitamin B_{12}

5.2 Elements in biological processes: essential, major, trace and ultra trace. Basic chemical reactions in the biological systems and the role of metal ions (specially Na^+, K^+, Mg^{2+}, Ca^{2+}, $Fe^{3+/2+}$, $Cu^{2+/+}$ and Zn^{2+}). Metal ion transport across biological membrane.

5.3 Structure and functions of Metalloproteins and enzymes– cytochromes and ferredoxins, carbonate bicarbonate buffering system and carbonic anhydrase. Biological nitrogen fixation, Photosynthesis– Photosystem-I and examples.

TEXT BOOKS

1. E. Huheey, E. A. Kieter and R. L. Keiter, Inorg. Chem., 4th ed., Harper Collins, NY., 1993.
2. Madan, Malik, Tuli, Selected Topics in Inorganic Chemistry, S Chand (1 November 2010).
3. Asim. K. Das, Fundamental Concepts of Inorganic Chemistry volume-4, CBS Publisher 2010.
4. Asim. K. Das, Fundamental Concepts of Inorganic Chemistry volume-5, CBS Publisher 2010.
5. Asim. K. Das, Fundamental Concepts of Inorganic Chemistry volume-6, CBS Publisher 2010.
6. R. D. Madan, Modern Inorganic Chemistry, S Chand,1987.
7. B. R. Puri, L. R.Sharma, K. C. Kalia, Principles of Inorg. Chem., S. Lal N. Chand 1996.
8. P. L. Soni, Mohan Katyal Textbook of Inorganic Chemistry, Sultan Chand & Sons.
9. Sathya Prakash, G. D. Tuli, Advanced Inorganic Chemistry volume-1, S Chand, 2000
10. Sathya Prakash, G. D. Tuli, Advanced Inorganic Chemistry volume-2, S Chand, 2000
11. F. Purcell, C. Kotz, Inorganic Chemistry, Cengage Publisher, 2010.
12. R. Gopalan, V. Ramalingam, Coordination Chemistry, Vikas Publication House Pvt Ltd; First edition (2008).
13. Ayodhya Singh, Sanjay Kumar Singh, Bioinorganic Chemistry 1st Ed., Campus Books International, 2003.
14. Hussain K. Reddy, Bioinorganic Chemistry, newagepublishers; First edition (1 January 2003)

REFERENCE BOOKS

1. D. F. Shriver and D. W.Atkins, Inorg. Chemistry,3rd ed., W. H .Freeman and Co., London,1999
2. T. Moeller, Inorganic Chemistry: A Modern Introduction, Wiley, New York, 1990.
3. J. D. Lee, Concise Inorganic Chemistry, 5th ed., Blackwell Science, London, 1996.

4. F. A. Cotton, G.Wilkinson and P. L.Guas, Basic Inorganic Chemistry, 3 Ed.,JW, 1994.Solid State Chemistry and its applications by A.R.West, John-Wiley and sons, 1987.
5. Walter D. Loveland, David J. Morrissey, Glenn T. Seaborg, Modern Nuclear Chemistry, 2nd Edition

WEB REFERENCE

1. https://www.slideshare.net/ShikhaPopali1/wiliknsons-reagent-199340804
2. https://www.ias.ac.in/public/Volumes/reso/004/09/0063-0081.pdf
3. https://nptel.ac.in/courses/104/108/104108062/
4. https://nptel.ac.in/content/storage2/courses/104106064/lectures.pdf

QUEEN MARY'S COLLEGE (A), CHENNAI-4
B.Sc - CHEMISTRY
PHYSICAL CHEMISTRY – III
SEMESTER VI

Course No. : XVIII **Max Marks: 75**
Code: **Credits: 5**

LEARNING OBJECTIVE

- To enable the students to understand the effect of pressure and temperature on phase equilibrium.
- To know the relation between colligative properties and molecular weight of solutes.
- To relate the rates of chemical reactions with different temperatures.

COURSE OUTLINE

UNIT – I PHASE EQUILIBRIA- I **18 hrs**

1.1 Phase Rule: Concepts of phase, component and degrees of freedom, with examples. Gibb's phase rule – derivation. Clapeyron and Clausius-Clapeyron equations and their applications to equilibria in phase transitions. (solid – liquid, liquid – vapour, solid – vapour)

1.2 One-component system: Phase diagrams: Water and sulphur systems and phosphorous system.

1.3 Two component system: (i) Simple eutectic: Lead-silver system. (ii) Formation of compound with congruent melting point: Ferric chloride – water system.

UNIT- II SOLUTIONS OF NON- ELECTROLYTES – II **18 hrs**

2.1 Ideal and non-ideal solutions - Raoult's law. Thermodynamics of solutions – criteria for ideal solutions - positive and negative deviations from the law. Vapour pressure-Composition curves of completely miscible binary solutions.

2.2 Fractional distillation of binary liquid solutions - Azeotropic mixtures; Lever rule and fractional distillation - Distillation of immiscible liquids - steam distillation.

2.3 Solubility of partially miscible liquid - conjugate solutions and CST- solutions showing UCST, LCST, and both. Effect of addition of solute on CST. Solubility of gases in liquids - factors influencing the solubility - Henry's law and its relationship with Raoults law.

UNIT – III COLLIGATIVE PROPERTIES OF SOLUTIONS AND DISTRIBUTION LAW **18 hrs**

3.1 Lowering of vapour pressure: Thermodynamics derivation for elevation of boiling point and depression of freezing point. Osmosis and osmotic pressure-Relationship between osmotic pressure and vapour pressure. Vant Hoff's theory of dilute solutions. Analogy between solute particles and gas molecules.

3.2 Determination of molecular weight by Cottrell's, Beckmann's and Berkeley and Hartley method.

3.3 Distribution law: Thermodynamic derivation; limitation of the law, application in studying association, dissociation and solvation. Applications of distribution law. Study of formation of complex ions.

UNIT – IV PHOTOCHEMISTRY **18 hrs**

4.1 Photochemical reactions - comparison with thermal reactions. Laws of photochemistry - quantum yield - primary and secondary processes – explanation for low and high quantum yields – chemical actinometers. Kinetics of photochemical reactions of H_2-Cl_2 and H_2-Br_2.

4.2 Jablonski energy level diagram – Radiationless transitions – Internal conversion and Inter system crossing. Radiative transitions – Fluorescence and Phosphorescence – comparison - factors influencing fluorescence intensity - Photosensitization - Chemiluminescence.

UNIT – V CATALYSIS **18 hrs**

5.1 Types of catalysts, general characteristics of catalytic reactions – types of catalysis - Homogeneous catalysis - Reactions in gas phase and in liquid phase – theories of homogenous catalysis - Acid-base catalysis - Enzyme catalysis – Michaelis-Menten mechanism - factors affecting enzyme catalysis.

5.2 Heterogeneous catalysis: Theories of heterogenous catalysis – Physisorption and Chemisorption. Adsorption isotherms - Freundlich and Langmuir (derivation required). Its application to slightly, strongly, and moderately adsorbed systems. Theory of heterogeneous catalysis on the basis of Langmuir adsorption - Uni and bimolecular reactions on solid surfaces.

TEXT BOOKS

1. S. H. Maron and J. B. Lando, Fundamentals of Phy. Chem., Macmillan Ltd, NY, 1966.
2. B. R. Puri and L. R. Sharma, Principles of Phy. Chem., Shoban Lal Nagin Chand and Co. 33rd ed, 1992.
3. K.K.Rohatgi Mukherjee, Fundamentals of Photochem. (Rd ed.), Wiley Eastern Ltd., 1996.
4. A.W. Adams, Text book of Physical Chemistry.
5. D.N.Bajpai, Advanced Physical Chemistry, S.Chand and Co.Ltd,New Delhi,2012.
6. B.S.Bahl, G.D.Juli, Arun Bahl, Essentials of Physical chemistry, S.Chand.

REFERENCE BOOKS

1. S. K. Dogra and S. Dogra, Phys. Chem. through problems, New age international, 1996.
2. Gilbert. W. Castellan, Physical Chemistry, Narosa publishing house, third edition 1985.
3. P. W. Atkins, Physical Chemistry, Oxford university press, 1978.
4. K. L. Kapoor, A Textbook of Phys. Chem., (volume-2 and 3) Macmillan, India Ltd, 1994.
5. sK.L. Kapoor, A Textbook of Physical Chemistry, (Volume-4), Macmillan India Ltd., 1992.
6. J. N. Gurtu and Mr. S. Razdan, Phase rule.

WEB REFERENCE

1. **https://phet.colorado.edu/sims/html/states-of-matter/latest/states-of-matter_en.html**
2. https://www.youtube.com/watch?v=v1Lx_ZoV5w4
3. https://nptel.ac.in/content/storage2/courses/103103026/pdf/mod1.pdf

QUEEN MARY'S COLLEGE (A), CHENNAI-4
B.Sc - CHEMISTRY
ELECTIVE –II A
CHEMISTRY OF MATERIALS
SEMESTER VI

Course No. : XIX **Max Marks: 75**
Code: **Credits: 5**

LEARNING OBJECTIVE

- To give an insight into the fascinating area of Solid state Chemistry and Material science
- To enable the students to understand the role of semiconductors.
- To develop an understanding on the electrical and magnetic properties of solids.

COURSE OUTLINE

UNIT –I STRUCTURES OF SOLIDS 18 hrs

1.1 Introduction to solids – crystalline and amorphous. Space lattice-unit cell- miller indices - Bravais lattices –lattice plane- Bragg's equation –derivation-its applications.

1.2 Types of solids- metallic, ionic crystals- powder and single crystal methods and applications.

1.3 Radius ratio-rules – coordination number. Packing arrangement – different structure types in solids – rock salt, zinc blende, wurtzite, fluorite and antiflourite, spinel and inverse- spinel and perovskite structures.

UNIT – II PREPARATIVE METHODS AND CHARACTERIZATION 18 hrs

2.1 Solid state reactions – ceramic method, sol-gel, hydrothermal, high pressure, zone refining, CVD, Czochralski and Bridgman and Stockbarger methods.

2.2 Physical methods – thermogravimetric and differential thermal analysis and scanning electron microscopy (only introduction and application).

UNIT – III ELECTRICAL AND OPTICAL PROPERTIES 18 hrs

3.1 Defects in solid state – point defects – Frenkel and Schottky defects and non stoichiometric defects.

3.2 Conductors – variation of conductivity with termperature – semiconductors – p and n types, pn – junction, photoconduction, photo voltaic cell and photogalvanic cell-solar energy conversion, organic semiconductor.

3.3 Piezoelectric, pyro-electric and ferroelectrics (introduction and application). Photoluminescence.

UNIT – IV MAGNETIC PROPERTIES 18 hrs

4.1 Magnetic properties – classification - diamagnetic, paramagnetic, antiferromagnetic, ferro and ferri magnetic – magnetic susceptibility.

4.2 Variation with temperature – Curie – Wiess law, Curie temperature and Neel temperature. Permanent and temporary magnets.

UNIT – V SPECIAL MATERIALS 18 hrs

5.1 Superconductivity – introduction, Meissner effect – mention of Bardeen, Cooper and Schrieffer theory and Cooper pairs – examples of superconducting oxiders, Chevrel phases – applications of superconducting materials.

5.2 Ionic conductors – sodium-alumina, sodium-sulphur battery. Intercalation – layered compounds – graphitic compounds. Special applications of solid state materials. High energy battery, lithium cells.

5.3 Liquid crystals: nematic, cholesteric and smectic types and applications.

TEXT BOOKS

1. Solid State Chemistry-An introduction by Lesley Smart and Elaine Moore, Chapman Hall, London,1992.

2. Solid State Chemistry by M.G. Arora, Anmol Publications, New Delhi 2001.

3. Materials Science by P.K. Palanisamy, Scitech Publications, Chennai, 2003.

REFERENCE BOOKS

1. Modern Inorganic Chemistry by W.L. Jolly, Mc Graw Hill Book Company, NY, 1989.
2. Inorg. Chem. by D.F.Shriver and P.W.Atkins, Longford, Oxford University Press, 1990.
3. Introductory Solid State Physics by H.P. Meyers, Viva Books Private Limited, 1998
4. Solid State Chemistry and its applications by A.R.West, John-Wiley and sons, 1987.
5. Modern aspects of Inorg. Chem., H.J. Emelius and A.G. Sharpe, U. Book stall, 1989.
6. Ionic crystals, Lattice defects and nonstoichiometry, N.N. Greenwood, Butterworths, London, 1968.
7. Solid State Physics by Charles Kittel, Johny-Wiley and Sons, NY, 1966.

WEB REFERENCE

1. https://youtu.be/G76H7A6_iyo
2. https://youtu.be/l_Og5qlqv-Y
3. https://youtu.be/D-9M3GWoBrw

QUEEN MARY'S COLLEGE (AUTONOMOUS) CHENNAI – 4

B. Sc. CHEMISTRY

ELECTIVE – II-B
NANO CHEMISTRY
Semester- VI

Course No. : XX **Max Marks: 75**

Code: **Credits: 5**

LEARNING OBJECTIVES

1. To acquire knowledge about nanochemistry
2. To learn the synthesis of nanomaterials, characterization and applications.

COURSE OUTLINE

UNIT - I FUNDAMENTALS AND OVERVIEW OF NANOSCIENCE (18 hrs)

Nano revolution of the 20th century-Basic definition of nanomaterials-Structure-Nucleation and grain growth-Grain boundaries, Properties at nanoscale: Strength and Hardness, optical, electrical, magnetic, mechanical and chemical properties.

UNIT – II SYNTHESIS OF NANOMATERIALS (18 hrs)

Top down approach – Nanolithography, Chemical Vapour Deposition (CVD). Bottom up approach - sol-gel processing, chemical synthesis. self assembly-Supramolecular approach. Reverse micelles and role of surfactants, capping of nanoparticles, Synthesis, purification, properties and uses of CNT, metal Nanoparticles. Nano tubes, Nano rods, Bucky balls-fullerenes, Nanofibers, Nanoshells. Semiconductor Nanoparticles - Energy band structure of Semiconductors Quantum dots-Quantization effect.

UNIT – III CHARACTERISATION OF NANOMATERIALS-I (18 hrs)

Theories and Techniques used for characterization-UV-Visible and PL spectroscopy-XRD-Electron microscopes-SEM, TEM, HR-TEM (SAED).

UNIT – IV CHARACTERISATION OF NANOMATERIALS-II (18 hrs)

Theories and Techniques used for characterization SPM, AFM, STM, XPS, XANES.

UNIT - V APPLICATIONS OF NANOMATERIALS (18 hrs)

Solar energy conversion and catalysis - Uses of Nanocomposites, chemical and nano biosensors. Nanomedicine and Nanobiotechnology-NEMS. Nanomaterials in bone

substitutes and dentistry, drug delivery and its application- nanoparticles in cancer targeting and treatment. Food and cosmetic applications, textiles, paints, Nanotechnology in agriculture, fertilizer and pesticides. Nanoparticles in Pollution control.

REFERENCE BOOKS

1. Pradeep, T., "Nano: the Essentials", Tata McGraw Hill, New Delhi, 2007.
2. Rao, C.N.R. and Cheetham, A.K., "The chem. of Nanomaterials: Synthesis, Properties and Applications", Wiley-VCH, 2004.
3. Hari Singh Nalwa, "Nanostructured materials and Nanotechnology", Acad. press, 2002.
4. Charles P. Poole and Frank J. Owens, "Intro. to Nanotechnology" Wiley-Intersci., 2003.
5. A.Nanobook, "Organic and Inorganic Nanostructures", Artech House, 2005.
6. Sulabha K. Kulkarni, "Nanotech.: Principles and Practices", Capital Publishing Co, 2007.

Web References and e-learning sources:

1. https://youtu.be/fZlsUFhwpyQ (space elevator)
2. https://youtu.be/fVCZej5Z5yg
3. https://youtu.be/dlCCNMtoJvk /International University
4. https://youtu.be/eXusvz0bI4I
5. https://youtu.be/ksQT1W0cmHE / Hands on training (virtual lab videos)

QUEEN MARY'S COLLEGE (AUTONOMOUS) CHENNAI-4
B.Sc. CHEMISTRY – SEMESTER-VI
ELECTIVE –II-C
INDUSTRIAL CHEMISTRY

Course No. : XXI **Max Marks: 75**
Code: **Credits: 5**

Objectives : To enable a student to understand

1. The various types of fuels, their composition and uses.
2. Use of chemicals in the improvement of agricultural crops.
3. Methods employed for purification of water for industry and home.
4. Pollution occurring from various sources and its consequences.

UNIT – 1: INDUSTRIAL FUELS

1.1 **Energy Sources**: non-renewable, classification of fuels, Calorific value of fuels and its determination.

1.2 **Solid Fuels**: Coal- types – properties and uses – lignite, sub-bituminous coal, bituminous coal and anthracite. Coking and non-coking coal.

1.3 **Liquid fuels**:Refining of crude petroleum and uses of fractions. Hydrodesulphurisation.

Cracking: thermal and catalytic (fixed bed and fluidized bed catalysis). Octane number. Production and uses of tetraethyl lead, ETBE and MTBE.

1.4 **Gaseous fuels:** Natural gas and gobar gas - production, composition and uses, Gobar electric cell.

UNIT – 2 AGRICULTURAL CHEMISTRY

2.1 **Fertilizers**: NPK, superphosphate, triple superphosphate, uses of mixed fertilizers, Micronutrients and their role, biofertilizers, plant growth hormones.

2.2 **Pesticides**: Classification of pesticides with examples (a) Insecticides: stomach poisons, contact insecticides, fumigants. Manufacture and uses of insecticides. DDT, BHC (gammaxane: Conformation of gamma isomer) pyrethrin. Mention of aldrin, dieldrin, endrin and pentachlorophenol (and its Na salts) and Biopesticides. (b) Herbicides: Manufacture of 2, 4-D and 2, 4, 5-T (c) Fungicides: Preparation of Bordeaux mixture. Mention of lime-sulphur, creosote oil and formula.

UNIT-3 Sugar and Paper industry:

3.1 **Sugar Industry**-Double sulphitation process. Refining and grading of sugar. Saccharin: synthesis and use as a sugar substitute – aspartame. Ethanol: manufacture from molasses by fermentation.

3.2 **Paper Industry**: Manufacture of paper - production of sulphite pulp and conversion to paper (bleaching, filling, sizing and calendaring)

UNIT – 4 WATER TREATMENT

4.1 **Introduction:** Hardness of water-temporary and permanent hardness, Units of hardness, disadvantages of hard water – in domestic, in industry and in steam generation in boilers. Effect of iron and manganese in water. Estimation of hardness – EDTA method – Estimation of total hardness – O.Hehner's method or alkali titration method.

4.2 **Water softening methods**- Industrial Purpose, Lime – soda process, zeolite process, ion exchange – Demineralisation process. Mixed – bed deionisation. Domestic Purpose- Removal of suspended impurities, Removal of microorganism– Chlorination-Breakpoint Chlorination.Reverse osmosis-Desalination- Wastewater treatment.

UNIT – 5 INDUSTRIAL SAFETY AND CHEMICAL TOXICOLOGY

5.1 **Industrial** process safety – PPEs – Effluent treatment - RCL - Fire fighting methods – Types of fire extinguisher.

5.2 **Chemical toxicology:** Effect of toxic chemicals or enzymes. Lead, mercury and cyanide pollution and their biochemical effects. Carbon monoxide, sulfur dioxide, oxides of nitrogen, ozone – biochemical effects.

5.3 **Quality control**: ISI specification. Patent: Purpose and procedures.

REFERENCE BOOKS

1. Norris Shreve, R and Joseph A. Brink. jr. Chemical process industries, 4th ed.,; Mc. Graw Hill, kogakusha, Ltd : 1977.
2. George T. Austin. Shreve's chemical process industries, 5th ed.; Mc graw – hill : 1984.
3. Subba rao, N. S. Biofertilizers in agriculture; Oxford and publishing co.: New Delhi 1982.
4. Jain, P.C. and Jain, M. Engineering chemistry, 10th ed.; Dhanpat Rai and sons: Delhi, 1993
5. Kamaraj, P, Jeyalakshmi, R. And Narayanan, V. Chemistry in engineering and technology; Sudhandhira publication : Chennai, 2001.
6. Kuriakose, J.C. and Rajaram, J. Chemistry in engineering and technology. Vol.2; Tata Mc Graw Hill, New Delhi, 1988.
7. De, A.K. Environmental chemistry 2nd ed.; Wiley Eastern Ltd., 1987.
8 Sharma, B.K, Industrial Chemistry, Krishna Prakashan.

QUEEN MARY'S COLLEGE (A), CHENNAI-4
B.Sc - CHEMISTRY
PRACTICAL IV- GRAVIMETRIC ESTIMATION AND ORGANIC ANALYSIS
SEMESTER- VI

Course No. : XXII **Max Marks: 75**
Code: **Credits: 5**

LEARNING OBJECTIVES:

- To make the students have hands on experience and knowledge on the techniques involved in precipitation, filtration and weighing using the principles of gravimetric analysis.
- To impart knowledge on identification and confirmation of the special elements and functional groups of organic compounds.

COURSE OUTLINE

Paper I Gravimetric Estimation (4 hrs)

1. Estimation of Ba as Barium Chromate
2. Estimation of Lead as Lead Chromate
3. Estimation of Ba as Barium sulphate
4. Estimation of SO_4^{2-} as Lead sulphate
5. Estimation of Ni using DMG
6. Estimation of Mg as magnesium oxinate
7. Estimation of Ca as Calcium oxalate

Paper II Organic Analysis (2hrs)

Analysis of organic compounds containing the following functional groups:

1. Carboxylic acids (mono, di, saturated, unsaturated)
2. Phenols (mono, polyhydric, napthol etc.)
3. Aldehydes and Ketones
4. 1^0, 2^0, and 3^0 amines.
5. Esters
6. Nitro compounds (mono, di)
7. Carbohydrates (reducing and non reducing)
8. Anilides
9. Amides (mono, di)

TEXT BOOKS

1. Major R. Ramasamy, Practical Organic Chemistry, Priya Publications, 2017.

REFERENCE BOOKS:

1. A.I. Vogel, A text book of practical organic chemistry, Longman Publishers, 6th Edn., 2009.
2. N.S. Gnanapragasam, G. Ramamurthy, Organic Chemistry Lab manual, S. Viswanathan printers and publishers Pvt. Ltd., Reprint 1996.
3. J.N. Gurtu and R. Kapoor, Advanced Experimental Chemistry (Organic), S. Chand and Co., 1987.
4. V. Venkatesan, R. Veeraswamy, A. R. Kulandaivelu, basic principles of practical chemistry, S. Chand and Sons, 2004.

Web Links:

1. https://vlab.amrita.edu/
2. https://vlabs.iitb.ac.in/vlab/
3. https://www.youtube.com/watch?v=WZ4f1YQ04sI
4. https://www.youtube.com/watch?v=X7ZJqLEhX9k

QUEEN MARY'S COLLEGE (A), CHENNAI-4
B.Sc - CHEMISTRY
ALLIED CHEMISTRY – I
(For B.Sc. Physics, Biochemistry, Botany, Zoology & Homescience)
SEMESTER- III

Course No. : XXIII **Max Marks: 75**
Code: **Credits: 4**

LEARNING OBJECTIVES

- To understand the fundamentals of nuclear chemistry and properties of fundamental particles.
- To procure knowledge on requisites and advantages of gaseous fuels, their preparation and uses.
- To get a thorough knowledge on the vital role of aminoacids, proteins and nucleic acids.
- To differentiate photochemical reactions from thermal reactions and study the outlining laws of photochemistry
- To introduce various theories defining acids and bases.

COURSE OUTLINE

UNIT-I ACIDS AND BASES (12 Hrs)

Acids, bases-theories of acids and bases-Arrhenius-Lowry-Bronsted-Lewis concept. Buffer solution – types - buffer action - biological and industrial applications of buffer solution.

UNIT-II AMINO ACIDS AND PROTEINS (12 Hrs)

Amino acids-classification-zwitter ion-isoelectric point, preparation by Strecker synthesis and Gabriel synthesis.

Peptides-synthesis of peptide by Bergmann method. Protein-simple and conjugated proteins-globular and fibrous proteins-colour reactions of proteins-primary and secondary structure of proteins.

Nucleic acids-preliminary idea about RNA and DNA.

UNIT- III PHOTOCHEMISTRY (12 Hrs)

Photochemistry - difference between thermal and photochemical reactions-Grotthus-Draper law-Stark-Einstein law of photochemical equivalence-quantum yield - photosensitisation- photosynthesis-fluorescence-phosphorescence.

UNIT- IV FUELS (12 Hrs)

Gaseous Fuel-requisites of a good fuel-advantages of gaseous fuel -natural gas, water gas, semi water gas, producer gas and LPG(composition and uses only)-advantage of LPG over other gaseous fuels-gobar gas-production and uses.

UNIT - V NUCLEAR CHEMISTRY (12 Hrs)

Fundamentals of nuclear chemistry-properties of ⟨, ®, © rays-fundamental particles of atom-nucleons-energy particles. Soddy-Fajan's group displacement law. Isotopes, Isobars, Isotone (definition with example), magic numbers - differences between chemical reactions and nuclear reactions.

TEXT BOOKS

1. H. J. Arnikar, Essentials of Nuclear Chemistry, New Age International Private Limited; 4 edition (1 January 2011)
2. R. D. Madan, Modern Inorganic Chemistry, S Chand,1987.
3. B. R. Puri, L. R.Sharma, K. C. Kalia, Physical Chemistry, S. Lal N. Chand 1996.
4. P. L. Soni, Organic Chemistry, Sultan Chand & Sons.
5. Jain And Jain, Engineering Chemistry, Dhanpat Rai Publishing Company Private Limited-New Delhi; Sixth edition (2013)
6. Ancillary Chemistry- Dr.V.Veeraiyan and A.N.S.Vasudevan
7. Fundamentals of Chemistry- R.Gopalan and S.Sundaram

WEB REFERENCES

1. https://web.vscht.cz/~dolezala/FCHL/04%20Amino%20acids.pdf
2. https://www.toppr.com/ask/content/video/secondary-structure-of-proteins-english-
3. https://www.rsc.org/images/EiC%20v1i2%20The%20Theory%20of%20Acids%20and ses_tcm18-230799.pdf

QUEEN MARY'S COLLEGE (A), CHENNAI-4
B.Sc - CHEMISTRY
ALLIED CHEMISTRY – II
(For B.Sc. Physics, Biochemistry, Botany, Zoology & Homescience)
SEMESTER-IV

Course No. : XXIV **Max Marks: 75**
Code: **Credits: 4**

LEARNING OBJECTIVES

- The target of the course is to impart the knowledge about Polymer chemistry, preparation and properties of some polymers.
- state the details about Fertilizers and its preparation properties.
- convey carbohydrates and its properties.
- Tells the Laws of thermodynamics.
- Set forth the knowledge of batteries and their types.

COURSE OUTLINE

UNIT- I CARBOHYDRATES (12 Hrs)

Carbohydrates- classification, preparation and properties of glucose and fructose- inter conversion of glucose and fructose. Sucrose-properties, structure and uses. Starch-structure and uses .Cellulose -structure and uses.

UNIT- II FERTILIZERS (12 Hrs)

Fertilizers –Micro and macro nutrients (definition and example)–requisites of good fertilizer- NPK fertilizer:preparation and properties of urea, ammonium sulphate, super phosphate of lime, triple super phosphate and potassium nitrate.

UNIT- III THERMODYNAMICS (12 Hrs)

System-surrounding-Intensive and extensive variables; state and path functions; isolated, closed and open systems-zeroth law of thermodynamics. First law of thermodynamics-mathematical form- Heat capacity, relation between CP and CV. Isothermal process.

UNIT- IV ELECTROCHEMISTRY (12 Hrs)

Batteries-primary and secondary batteries (explain with example)-difference between primary and secondary batteries. Lead storage battery-cell diagram, cell reaction and uses. Fuel cell-H_2-O_2 fuel cell- explanation with diagram.Corrosion-types, corrosion control methods.

UNIT- V POLYMER CHEMISTRY (12 Hrs)

Introduction, classification of polymers, types of polymerisation, addition polymerization, condensation polymerization, Thermoplastic and thermosetting resins, difference between thermoplastic and thermosetting resins , preparation , properties and uses of polythene, PVC, Teflon, nylon6,6 and polyesters.

TEXT BOOKS

1. Gowarikar, Viswanathan, Polymer Science, New Age International Pvt Ltd Publishers (30 January 2010)
2. B. K. Sharma, Industrial Chemistry, Krishna Prakashan Media (p) Ltd. (2011)
3. B. R. Puri, L. R.Sharma, K. C. Kalia, Physical Chemistry, S. Lal N. Chand 1996.
4. P. L. Soni, Organic Chemistry, Sultan Chand & Sons.
5. Jain And Jain, Engineering Chemistry, Dhanpat Rai Publishing Company Private Limited-New Delhi; Sixth edition (2013)
6. Ancillary Chemistry- Dr.V.Veeraiyan and A.N.S.Vasudevan
7. Fundamentals of Chemistry- R.Gopalan and S.Sundaram

WEB REFERENCES

1. **https://www.informit.com/articles/article.aspx?p=2235827**
2. https://www.ramauniversity.ac.in/online-study-material/agriculture/bsc/vsemester/manures,fertilizersandsoilfertilitymanagement/l-7.pdf
3. https://www.britannica.com/science/thermodynamics
4. https://components101.com/articles/different-types-of-batteries-and-their-uses

QUEEN MARY'S COLLEGE (A), CHENNAI-4
B.Sc - CHEMISTRY
ALLIED CHEMISTRY PRACTICALS
(For B.Sc. Physics, Biochemistry, Botany, Zoology & Homescience)

SEMESTER- IV

Course No. : XXV **Max Marks: 75**
Code: **Credits: 2**

LEARNING OBJECTIVES:

To enable the students to

- understand and follow lab safety norms
- perform preliminary chemical tests
- detect the special elements present
- identify functional groups in organic compounds by confirmatory tests
- learn the methods of preparing suitable derivatives.

COURSE OUTLINE

Analysis of organic compounds containing the following functional groups:

1. Mono carboxylic acid
2. Phenols
3. Aldehydes and Ketones
4. Primary amines
5. Carbohydrates
6. Amides (mono, di)

TEXTBOOKS

1. Major R. Ramasamy, Practical Organic Chemistry, Priya Publications, 2017.

REFERENCE BOOKS

1. A.I. Vogel, A text book of practical organic chemistry, Longman Publishers, 6th Edn., 2009.
2. N.S. Gnanapragasam, G. Ramamurthy, Organic Chemistry Lab manual, S. Viswanathan printers and publishers Pvt. Ltd., Reprint 1996.

WEB REFERENCES

1. https://www.vlab.co.in/
2. https://vlab.amrita.edu/
3. https://vlabs.iitb.ac.in/vlab/

QUEEN MARY'S COLLEGE (A), CHENNAI-4
B.Sc - CHEMISTRY
NON MAJOR ELECTIVE –I-MEDICINAL CHEMISTRY
SEMESTER-III

Course No. : XXVI **Max Marks: 75**
Code: **Credits: 2**

LEARNING OBJECTIVES

1.To understand the medicinal value of Indian plants.

2. To create awareness on symptoms of diabetes and its control.

3. To get a thorough knowledge on causes and consequences of hypertension.

4. To identify blood groups and understand Rh factor.

5. To realise the role of vitamins and hormones in human morphology.

COURSE OUTLINE

UNIT – I INDIAN MEDICINAL PLANTS (3 Hrs)

Indian Medicinal Plants : Thulasi, Neem, Hibiscus, Mango, Keezhanelli – chemical constituents and uses.

UNIT – II HYPOGLYCEMIC DRUGS (3 Hrs)

Hypoglycemic Drugs: Diabetes – types – causes – symptoms – drugs – control measures.

UNIT – III ANTIHYPERTENSIVE DRUGS (3 Hrs)

Antihypertensive Drugs: Blood pressure – Hypertension, Hypotension, Hypertension-causes, symptoms – Remedial measures – drugs.

UNIT – IV BLOOD (3 Hrs)

Blood: Composition – Groups – Functions – Rh factor.

UNIT – V VITAMINS AND HORMONES (3 Hrs)

Vitamins and Hormones : Vitamin – A, B, C, D, E, K – sources, biological role – deficiency disease.

Hormones – Biological role of Thyroxin, Oxytocin and Sex hormones.

WEB REFERENCE

1. https://www.youtube.com/watch?v=-a-Pu5fi6wo
2. https://www.youtube.com/watch?v=DnPFYdV5i5w
3. https://www.youtube.com/watch?v=KXm3D0NlpgI
4. https://www.healthline.com/health/diabetes
5. http://www.pulsenotes.com/wp-content/uploads/2018/03/Pulsenotes-Hypertension- notes.pdf
6. https://www.healthline.com/health/blood-typing
7. https://www.youtube.com/watch?v=c-f7tc_VO-0
8. https://www.youtube.com/watch?v=cFslt2ps634

QUEEN MARY'S COLLEGE (A), CHENNAI-4
B.Sc - CHEMISTRY
NON MAJOR ELECTIVE –II- CHEMISTRY IN DAY TODAY LIFE
SEMESTER- IV

Course No. : XXVII **Max Marks: 75**
Code: **Credits: 2**

LEARNING OBJECTIVES

- To attain on knowledge about various cosmetics, soaps and detergents
- To know about drugs used for various diseases and their importance our day today life
- To interpret applications of rubber in various fields based on their properties.
- To infer knowledge on adulteration and types and methods to identify adulterants.

COURSE OUTLINE

UNIT – I COSMETICS (3 Hrs)

Cosmetics : Creams – Perfumes – Talcum Powder – Deodorants.

UNIT – II SOAPS AND DETERGENTS (3 Hrs)

Soaps and Detergents: Constituents of soaps and detergents – Preparation – types – Cleansing action of soap.

UNIT – III DRUGS (3 Hrs)

Drugs: Analgesics – Antipyretics – antibiotics – antiseptics, disinfectants – definition, examples and applications.

UNIT – IV RUBBER (3 Hrs)

Rubber: Natural rubber – vulcanization – applications – synthetic rubbers.

UNIT – V FOOD ADULTERATION (3 Hrs)

Food Adulteration: Adulterants in milk, ghee, oil, coffee powder, tea, asafetida, chilli powder, pulses and turmeric powder – identification.

WEB REFERENCE

1. https://www.slideshare.net/bknanjwade/cosmetic-products
2. https://www.slideshare.net/muhammedthahir129/soap-and-detergents-15243636

3. **https://www.slideshare.net/nasertadvi/antiseptics-and-disinfectants-15555738**
4. **https://www.slideshare.net/lopezcasanova/best-practiceantisepticantimicrobial**
5. https://www.slideshare.net/PankajDas19/vulcanization-mechanism-of-natural-rubber
6. **https://www.slideshare.net/swatishikha10/food-adulteration-96507428**