GOVERNMENT ARTS COLLEGE (AUTONOMOUS), SALEM-7

NAAC REACCREDITED WITH B++

Master of Science (M.Sc) CHEMISTRY DEGREE COURSE

CHOICE BASED CREDIT SYSTEM (CBCS) – REGULATIONS AND SYLLABUS

(Effective from the Academic Year: 2017 – 2018 onwards)

1. Objectives of the Course

Life has changed more in the past two centuries than in all the previously recorded span of human history. In one way or another, all these changes involve CHEMISTRY, the study of the composition, properties and transformations of matter. Chemistry is deeply involved in both the changes that take place in nature and profound social changes of the past two centuries. In addition, chemistry is central to the current revolution in all sciences. No educated person today can understand the modern world without a basic knowledge of chemistry. An advanced course in chemistry will be a fascinating experience because it helps us to understand our surroundings. The major objectives of M.Sc. Chemistry course are:

- To impart knowledge in fundamental aspects of all branches of chemistry
- To acquire deep knowledge in the study of physical, chemical, electrochemical and magnetic properties, structure elucidation using various techniques and applications of various organic and inorganic materials
- To acquire basic knowledge in the specialized areas of chemistry and
- To train the students in various quantitative and qualitative analyses

2. CONDITIONS FOR ADMISSION:

A candidate, who has passed the B.Sc Degree Examination in Chemistry of the Periyar University or an equivalent examination of any other Universities accepted by the Syndicate of the Periyar University as equivalent there to, shall be permitted for admission and to appear and qualify for the Master of Science (M.Sc) Chemistry Degree Examination.

3. DURATION OF THE COURSE:

The duration of the Degree of Master of Science in Chemistry shall consist of two academic years of four semesters.

4. COURSE OF STUDY AND SCHEME OF EXAMINATION:

The detailed course of study and scheme of examination is provided in Table 1.

5. EXAMINATIONS:

The Theory Examination shall be of three hours duration conducted at the end of each semester. The Practical Examinations for M.Sc Courses shall be of five hours duration and will be conducted at the end of the even semester as II and IV semesters along with the theory papers. **The maximum mark for each paper and practical is 100**. The candidate failing to get the minimum marks required for pass in any theory papers/subject(s) shall be permitted to appear for

each failed subject(s) in the subsequent semester/examination. The candidate failing to get the minimum marks required for pass in any practical, may be permitted to appear in the subsequent / next regular even semester only. **There is no statutory provision to conduct instant or supplementary examination for the practical in the even semesters.**

6. PASSING MINIMUM:

For Theory Examination:

The breakup of marks shall be: 75 by written examinations [Semester External or S.E.] and 25 by Internal Assessment [I.A.]. The passing minimum for all theory papers (semester external) shall be 38 out of 75. The break up for internal assessment marks for theory papers will be as follows: Attendance: 5 + Assignment: 10 + Test: 10 = 25 Marks. There is no passing minimum for internal assessment. The passing minimum mark for all theory papers shall be 50 marks with both internal and external marks added together under the mandatory requirement that the candidate has secured not less than 38 out of 75 in the written examination. Candidates who score less than 38 out of 75 in the theory papers and secure more than 50 with internal assessment (out of 100), have NOT secured the passing minimum and are required to reappear for those papers in the subsequent semesters. Revaluation of theory papers, re-totalling of marks, supplementary and instant examination, and transparency of theory papers is allowed as per Government Arts College Autonomous and Periyar University norms. Candidates need to apply to the COE, through the Principal with proper endorsement and recommendation by the concerned tutor and head of department.

For Practical Examination:

The Practical Examinations for M.Sc Courses will be conducted at the end of the even semester as II, and IV Semesters only. The breakup of marks shall be Practical Examination - 60 marks and Internal Assessment - 40 marks. The breakup for internal assessment marks shall be Practical class Attendance: 10 + Class performance on continuous assessment 15 + Model Practical test: 15 = 40 Marks. There is no passing minimum for internal assessment for the practical. The passing minimum mark for all practical papers shall be 50 marks with both internal and external marks added together under the mandatory requirement that the candidate has secured not less than 30 out of 60 in the written examination. Candidates who score less than 30 out of 60 in the theory papers and secure more than 50 with internal assessment (out of 100), have NOT secured the passing minimum and are required to reappear for those practical in the subsequent even semesters. The distribution of marks for practical examination is as per Table 2.

Revaluation, re-totalling of marks, supplementary or instant examination, transparency of all theory papers are permitted and revaluation, re-totalling of marks, supplementary or instant examination, transparency of all practical papers are NOT permitted as per Government Arts College Autonomous and Periyar University norms/guidelines. The candidate has to apply and re-appear for the practical examination at the subsequent EVEN semester only.

The attendance and participation for the practical classes of a candidate pursuing M.Sc Chemistry Degree is mandatory and shall be a necessary criterion for the candidate to appear for the Examinations. A candidate shall be declared to have passed the Project / Dissertation Examination if he/she obtains not less 100 marks out of 200. A candidate who has not obtained the required minimum marks for a pass in his or her dissertation/project shall be required to appear for and pass the same at the next or subsequent even semester only.

7. CLASSIFICATION OF SUCCESSFUL CANDIDATES:

The performance of the student is indicated by the Grades and the corresponding Grade Point (GP), Grade Point Average (GPA) and Cumulative Grade Point Average (CGPA).

Grade	**Cumulative Grade Points Average**	**Grade Description**	**Range of Marks**
O	9.0-10	Outstanding	90-100
D+	8.0-8.9	Excellent	80-89
D	7.5-7.9	Distinction	75-79
A+	7.0-7.4	Very Good	70-74
A	6.0-6.9	Good	60-69
B	5.0-5.9	Satisfactory	50-59
RA	0	Re-Appear	0-49
ABSENT	0.0	ABSENT	ABSENT

A student is deemed to have completed a course successfully and earned the appropriate credit, only if, the candidate has earned a grade of B or above. RA denotes the candidate should Re-Appear for the examination.

GP = Marks obtained in a course x Credits / 10

GPA = Total Grade points earned in a semester / Total Credits registered in a semester

CGPA = Sum of Grade Points earned / Sum of Credits registered

Classification of CGPA

9 and Above	I CLASS-OUTSTANDING
8 and 8.9	I CLASS-EXCELLENT
7. 5 and 7.9	I CLASS-DISTINCTION
6. 0 and 7.4	I CLASS
5. 0 and 5.9	II CLASS

The above classification is based on the marks secured by a candidate in the Major Subjects, Major Electives and Non Major Electives.

8. RANKING:

Candidates who have passed all the examinations prescribed for the course **in their first appearance,** within the period of two academic years / four semesters from their year of admission **ONLY are eligible for ranking**. A candidate who is **absent** for one or more papers in a semester examination and who later appears for the same paper or papers in the subsequent semester examination **is NOT eligible for ranking** even though he/she has completed the course within two academic years / four semesters from their year of admission.

9. Attendance Requirement & Condonation of Attendance:

For Theory Examinations

The attendance shall be calculated on the basis of 90 days / 450 instructional hours per semester. Candidates are mandatorily required to have 75% or above in attendance to apply and appear for theory examinations without condonation of attendance. Those candidates whose attendance ranges from 65 to 74% may appear for the theory and practical examination after

payment of the appropriate condonation fee (Rs 500) through proper channel. The candidates with attendance percentage ranging from 50 to 65 cannot appear for the present theory examinations. They are mandatorily required to pay the condonation fee for the present semester and may be permitted to appear for the lapsed theory papers in the next or subsequent semester only. Candidates whose attendance is below 50% are barred from the theory examinations and mandatorily have to redo the course as per Government Arts College Autonomous and Periyar University norms/guidelines in force.

For Practical examinations

The attendance shall be calculated on the basis of 180 days / 900 instructional hours per year combining the odd and even semesters. Candidates are mandatorily required to have 75% or above in attendance to apply and appear for the practical examinations without condonation of attendance. Those candidates whose attendance ranges from 65 to 74% may appear for the practical examination after payment of the appropriate condonation fee (Rs 500) through proper channel. The candidates with attendance percentage ranging from 50 to 65 cannot appear for the present practical examinations. They are mandatorily required to pay the condonation fee for the present semester and may be permitted to appear for the lapsed practical papers in the next or subsequent even semester only. Candidates whose attendance is below 50% are barred from the practical examinations and mandatorily have to redo the course as per Government Arts College Autonomous and Periyar University norms/guidelines in force.

A candidate whose attendance for theory and practical classes calculated separately is within 65 to 74%, has to pay condonation fees separately for theory and practical examinations as Rs 500 + 500 = Rs 1000. Condonation fees are separate for theory and practical examinations and are NOT to be combined as a single fee of Rs 500. The candidate will be allowed to appear for both theory and practical examinations under the condition that the condonation fees have been paid for both theory and practical examinations.

10. QUESTION PAPER PATTERN:

The question paper pattern shall be as follows:

Time: 3 Hours - Maximum Marks: 75

Part A: 5 x 5 = 25 Marks

No. of questions = 5 (With internal choice)

All questions will carry equal marks. All questions are compulsory

Two questions will be set from each unit with internal choice

Each answer should be about 500 words.

Part B: 5 x 10 =50 Marks

No. of questions = 5 (With internal choice)

All questions will carry equal marks. All questions are to be answered

Two questions will be set from each unit

Each answer should be about 1000 words.

11. DISSERTATION:

(A) Topic:

The Broad Field for the dissertation shall be assigned to the candidate before the end of first semester and a copy of the same shall be submitted to the Head of Department and Controller of Examinations.

(B) Plan of Work:

The student shall prepare the plan of work for the dissertation and get the approval of the Supervisor. He / She should start the project work from the end of the second semester and submit the dissertation at the time of viva-voce examination at the end of the fourth semester. The dissertation shall be duly certified by the Supervisor and the Head of the Department.

(C) Dissertation work outside the College:

In case the student needs to avail facilities outside the college, (i.e.) from other University / Laboratory, they shall pursue the work with the permission of the Supervisor and acknowledge the outside facilities utilized by them. The student shall complete the dissertation work on or before 31st March, of a Calendar Year. Specific approval/permission of the College Principal / DCE shall be obtained when the student stays away for research work outside the college for a period exceeding two weeks.

(D) Submission of Dissertation:

The student shall prepare 2 copies of the dissertation and submit the same at the time of Viva – Voce, for evaluation by the Examiners. The dissertation should be in the format given in Annexure 1. After evaluation a soft copy of the dissertation is to be submitted to COE and Department Library.

(E) Marks for Dissertation:

The total marks for dissertation shall be 200, of which 150 marks are for dissertation work and 50 marks for Viva-Voce.

12. TRANSITORY PROVISION:

Candidates who were admitted to the M.Sc Chemistry Course of study in the year 2017 – 2018 are **permitted to appear for the examination under this regulation for a period of 5 years or ten consecutive semesters from their of year of admission to the course.** Thereafter they shall be permitted to appear for examination only under the regulations then in force.

13. Break up of Internal Assessment

For Theory Examinations

For Theory Examinations

There is no passing minimum for internal assessment for theory examinations. The break up is as follows: Attendance: 5 + Assignments: 10 + Test: 10 = 25 Marks.

The marks for attendance are given as follows:

Attendance percentage	**Marks**
> 95	10
91 to 95	8
86 to 90	6
81 to 85	4
76 to 80	2
Below 75	0

The marks for assignments are given as follows:

Candidates have to write at least one assignment per unit of a theory paper. An average of any three assessment mark will be taken for IA.

The marks for test will be given as below:

An average of any two Class test mark as part of continuous assessment awarded by the respective teacher and model examination mark will be taken as test mark for IA.

For Practical Examinations

There is no passing minimum for internal assessment for practical examinations. The break up is as follows:

Attendance: 10 + Class performance on continuous assessment: 15 + Model Practical tests: 15 = 40 Marks.

The marks for attendance are given as follows:

Attendance percentage	**Marks**
> 95	10
91 to 95	8
86 to 90	6
81 to 85	4
76 to 80	2
Below 75	0

14. COMMENCEMENT OF THIS REGULATION:

This regulation shall take effect from the Academic Year 2017 -2018. The students admitted to the first year of the PG Chemistry Course from 2017-2018 and thereafter shall follow these regulations.

Program outcome

Knowledge-Based

1. Graduates will be able to master a broad set of chemical knowledge concerning the fundamentals in the basic areas of the discipline (organic, inorganic physical and analytical chemistry).

2. Graduates will be able to solve problems competently by identifying the essential parts of a problem and formulating a strategy for solving the problem. They will be able to rationally estimate the solution to a problem, apply appropriate techniques to arrive at a solution, test the correctness of the solution, and interpret their results.

3. Graduates will be able to use modern library search tools to locate and retrieve scientific information about a topic, chemical, chemical technique, or an issue relating to chemistry.

4. Graduates will be able to acquire knowledge on modern social and political system which will make them a good social wellbeing. They will be aware of their social rights which make them responsible and to respect other fundamental rights.

Performance/Skills-Based

5. Graduates will be able to understand the objective of their chemical experiments, properly carry out the experiments, and appropriately record and analyze the results.

6. Graduates will be able to use standard laboratory equipment, modern instrumentation, and classical techniques to carry out experiments.

7. Graduates will know and follow the proper procedures and regulations for safe handling and use of chemicals.

8. Graduates will be able to communicate the concepts and results of their laboratory experiments through effective writing and oral communication skills.

Affective

9. Graduates will be able to successfully pursue their career objectives in advanced education in professional and/or graduate schools, in a scientific career in government or industry, in a teaching career in the school systems, or in a related career following graduation.

Program Specific outcome

10. This program includes recent addition of UGC –NET syllabus portions like supramolecular chemistry, green chemistry and nano materials chemistry.

11. Specifically, disconnection method in organic synthesis is a recent addition in pharmaceutical industry that caters method for custom synthesis.

12. Spectroscopic method of chemistry will provide knowledge in characterizing a new material and pursue their carrier in pharmaceutical and research carrier.

Relationship between the Major's core curriculum and student learning outcomes:

Sem No	Course Code	Title of the Course	Learning outcome											
			1	2	3	4	5	6	7	8	9	10	11	12
01	17PCH01	Organic Chemistry I	√	√							√	√	√	√
01	17PCH02	Physical Chemistry I	√	√							√	√		
01	17PCHM1	Advanced Inorganic Chemistry/ Polymer Chemistry	√	√	√						√	√		
02	17PCH03	Organic Chemistry II	√	√							√	√		
02	17PCH04	Inorganic Chemistry I	√	√							√	√		
02	17PCH05	Physical Chemistry II	√	√							√	√		
02	17PGNM1	Human Rights				√								
02	17PCHP1	Practical I (Organic Chemistry Practical-I)					√	√	√	√	√	√		√
02	17PCHP2	Practical II (Inorganic Chemistry Practical-I)					√	√	√	√	√	√		√
02	17PCHP3	Practical III (Physical Chemistry Practical-I)					√	√	√	√	√	√		√
03	17PCH06	Organic Chemistry III	√	√							√	√		
03	17PCH07	Physical Chemistry III	√	√							√	√		
03	17PCHM2	Spectroscopy and green chemistry/Medicinal Chemistry	√	√							√	√		√
03	17PGNM2	General Studies for competitive examinations				√								
04	17PCH08	Inorganic Chemistry-II	√	√	√						√	√		
04	17PCHP4	Practical IV (Organic Chemistry Practical-II)					√	√	√	√	√	√		√
04	17PCHP5	Practical V (Inorganic Chemistry Practical -II)					√	√	√	√	√	√		√
04	17PCHP6	Practical VI (Physical Chemistry Practical -II)					√	√	√	√	√	√		√
04	17PCHPR	Dissertation / Project work					√	√	√	√	√	√		√

Table 1 The Course Structure and Scheme of Examination

Sem. No	Course Code	Title of the Course	Exam Duration (Hr)	Credit	Marks		
					IA	SE	Total
01	17PCH01	Organic Chemistry I	3	5	25	75	100
01	17PCH02	Physical Chemistry I	3	5	25	75	100
01	17PCHM1	Elective Course 1: Advanced Inorganic Chemistry	3	5	25	75	100
02	17PCH03	Organic Chemistry II	3	5	25	75	100
02	17PCH04	Inorganic Chemistry I	3	5	25	75	100
02	17PCH05	Physical Chemistry II	3	5	25	75	100
02	17PGNM1	Non Major elective Common course I: Human Rights	3	3	25	75	100
02	17PCHP1	Practical I (Organic Chemistry Practical-I)	6	4	40	60	100
02	17PCHP2	Practical II (Inorganic Chemistry Practical-I)	6	4	40	60	100
02	17PCHP3	Practical III (Physical Chemistry Practical-I)	6	4	40	60	100
03	17PCH06	Organic Chemistry III	3	5	25	75	100
03	17PCH07	Physical Chemistry III	3	5	25	75	100
03	17PCHM2	Elective course 2 Spectroscopy and green chemistry	3	5	25	75	100
03	17PGNM2	Non Major elective Common course II: General Studies for competitive examinations	3	3	25	75	100
04	17PCH08	Inorganic Chemistry-II	3	5	25	75	100
04	17PCHP4	Practical IV (Organic Chemistry Practical-II)	6	4	40	60	100
04	17PCHP5	Practical V (Inorganic Chemistry Practical -II)	6	4	40	60	100
04	17PCHP6	Practical VI (Physical Chemistry Practical -II)	6	4	40	60	100
04	17PCHPR	Dissertation / Project work	--	10		200	200
Total				90			2000

Table 2 Distribution of marks for practical examinations

17PCHP1 - Organic Chemistry Practical-I		**17PCHP2 – Inorganic chemistry Practical -I**	
Organic analysis	35 marks	Inorganic Qualitative analysis	25 marks
Organic Preparation	10 marks	Inorganic Preparation	10 marks
		Colorimetric analysis	10 marks
Viva – Voce in practical	10 marks	Viva – Voce in practical	10 marks
Record	5 marks	Record	5 marks
Internal Assessment	40 marks	Internal Assessment	40 marks
Total	100 marks	Total	100 marks

17PCHP3-Physical chemistry Practical-I		**17PCHP4 – Organic chemistry Practical-II**	
Physical chemistry expts	45 marks	Organic Estimation	30 marks
Viva-voce in practical	10 marks	Organic Preparation	15 marks
Record	5 marks	Viva – Voce in practical	10 marks
		Record	5 marks
Internal Assessment	40 marks	Internal Assessment	40 marks
Total	100 marks	Total	100 marks

17PCHP5 –Inorganic chemistry Practical -II		**17PCHP6– Physical chemistry Practical - II**	
Quantitative analysis	30 marks	Experiment	45 marks
Inorganic Preparation	15 marks	Viva-voce in practical	10 marks
Viva-voce in practical	10 marks	Record	5 marks
Record	5 marks		
Internal Assessment	40 marks	Internal Assessment	40 marks
Total	100 marks	Total	100 marks

Annexure 1

Format to be followed:

The format/certificate for dissertation to be submitted by the students is given below:

Format for the preparation of project work:

(a) Title page

(b) Bonafide Certificate

(c) Acknowledgement

(d) Table of contents

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Format of the Title Page:

TITLE OF THE DISSERTATION

Dissertation Submitted in part fulfillment of the requirement for the Degree of Master of Science in Chemistry to Govt. Arts College (Autonomous), Salem – 7.

Student's Name:

Register Number

Guide Name

Designation

Department of Chemistry

Government Arts College (Autonomous)

SALEM – 636 007

Year:

Format of the Certificate:

CERTIFICATE

This is to certify that the dissertation entitled ---------- ---------- submitted in part fulfillment of the requirement of the degree of Master of Science in Chemistry to Government Arts College, Salem – 7 affiliated to Periyar University , Salem – 11 is a record of bonafide research work carried out by - ---------- under my supervision and guidance and that no part of the dissertation has been submitted for the award of any degree, diploma, fellowship or other similar titles or prizes and that the work has not been published in part or full in any scientific or popular journals or magazines.

Signature of the Guide

Examiners :

1. Internal Examiner : (Guide)

2. External Examiner

Place:

Date:

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) , SALEM – 7

M. Sc CHEMISTRY

FIRST SEMESTER

CORE COURSE : ORGANIC CHEMISTRY – I

COURSE CODE : 17PCH01 [75 Hours]

Learning Objectives:

- **To know foundation about type of organic reactions**
- **To understand structure and reactivity of organic chemicals**
- **To study the fundamentals of stereo chemistry**
- **To study fundamental ideas about substitution reactions**

Learning outcome :

- **Get introduced about fundamentals of organic reactions**
- **Know the reactions related to chemical structure**
- **Stereochemistry and conformational analysis has been introduced**
- **Got introduction about disconnection approach to chemical synthesis**

UNIT – I Types of Reactions, Mechanisms and Reaction intermediates (15 Hours)

Types of reactions : Substitutions, Additions, Eliminations, Rearrangements, Oxidation, Reductions and pericyclic reactions – a general study. Reaction mechanisms: Types of mechanisms: polar and non-polar mechanism– a general study. Reaction intermediates: Formation, stability and structure of carbonium ions, carbanions, carbenes, nitrenes , benzyne and free radicals. Long lived and short lived free radicals, methods of generation and detection of free radicals, free radical reactions: mechanism of Sandmeyer, Gomberg-Bachmann, Pschorr, Ullmann, Hunsdiecker, reactions Barton and Photo-Fries rearrangement.

UNIT - II Structure and Reactivity (15 Hours)

Effect of structure on reactivity – resonance and field effects, steric effects, quantitative treatment – the Hammett equation and linear free energy relationship, substituent and reaction constant, Taft equation. Thermodynamic and kinetic requirements for reactions, thermodynamic

and kinetic control reactions, Hammonds postulate, Microscopic reversibility, Marcus theory, Curtin-Hammett principle, Potential energy diagrams, transition states and intermediates, methods of determining mechanisms- identification of products and determination of the presence of an intermediate, isotopic labeling, isotope effects.

UNIT – III Stereochemistry (15 Hours)

Concept of chirality, recognition of symmetry elements and chiral structures, R – S nomenclature, diastereoisomerism in acyclic and cyclic systems, molecules with more than one asymmetric centre- examples of erythro and threo compounds. Fischer, Newman and Sawharse projections of erythro and threo forms of organic molecules and their inter-conversion. Homotopic, enantiotopic, diastereotopic H atoms, groups in organic molecules. Optical activity in the absence of chiral carbon – biphenyls, allenes and spiranes – R and S notations. Chirality due to helical shape, trans cyclooctene. Conformational analysis of decalins. Stereochemistry of the compounds containing nitrogen, sulphur and phosphorus. E – Z isomerism of olefins containing one double bond and more than one double bond.

UNIT – IV Aliphatic Nucleophilic Substitution Reactions (15 Hours)

The S_N1, S_N2, mixed S_N1 and S_N2, S_Ni and SET mechanisms. The neighbouring group mechanism, neighbouring group participation by π and σ bonds, anchimeric assistance. Nucleophilic substitution at an allylic, aliphatic trigonal and vinylic carbon. Reactivity effects of substrates structure, attacking nucleophile, leaving group and reaction medium, ambident nucleophile, regioselectivity. Substitution at carbon doubly bonded to oxygen and nitrogen, Williamson reaction, Von-braun reaction, hydrolysis of esters, Claisen and Dieckmann condensation. Problems in Aliphatic Nucleophilic Substitution Reactions.

UNIT V Disconnection approach (15 Hours)

An introduction to synthones and synthetic equivalents – disconnection approach – functional group interconversions – the importance of the order of events in organic synthesis – one and two C-X disconnections –One C-C disconnections – alcohols and carbonyls compounds – regio selectivity – two group C-C disconnections – Diels-Alder reactions, (1,3) and (1,5) difunctional compounds- Problems.

Text Books

1. Jerry March, Advanced Organic Chemistry- Reactions, Mechanisms and Structure, Fourth Edition, John Wiley & Sons 7th edition.(2015)
2. Francis A. Carey, Organic Chemistry, Third Edition, The McGraw-Hill Companies, Inc., 8th edition, 2015.
3. P. S. Kalsi, Organic Reactions and Mechanisms, Second Edition, New Age International Publishers, 2002.
4. Ernest L. Eliel, Stereochemistry of Carbon Compounds, T.M.H Edition, Tata McGraw-Hill Publising Company, 2001.
5. P. S. Kalsi, Stereochemistry – Conformation and Mechanism, 6th Edition, Wiley Eastern Limited, 2005.
6. I.L. Finar, Organic Chemistry, Volume. II, Fifth Edition, First Indian reprint, Pearson Education Asia Pvt. Ltd., (2002)
7. Organic Synthesis: The disconnection Approach by S.Warren, second edition, 2008, Wiley and sons

Reference Books

1. P.S. Kalsi, Stereochemistry and Mechanism through solved problems, Third Edition, New Age International Publishers, 2006.
2. D. Nasipuri, Stereochemistry of Organic Compounds, 3rd Edition, New Age International Publishers, 2011.
3. S.M.Mukherji and S.P.Singh, Reaction Mechanism in Organic Chemistry, 3rd Edn., Macmillan 1989.
5. R.T.Morrison and R.N.Boyd, Organic Chemistry, 6th Edn., Prentice-Hall,1992.
6. R.O.C. Norman, Principles of Organic Synthesis, 3rd Edition, Chapman and Hall, 1993.
8. R.M.Acheson, Introduction to Chemistry of Heterocyclic Compounds, 3rd Edn., Interscience Publishers, 1976.
9. J.A. Joule and G.F. Smith, Heterocyclic Chemistry, Van Notrand Reishord Co.,5th edition, London, 2010.

Task :

1. Search any two OTC drugs in the market, find out the structure and propose a synthetic scheme through disconnection.
2. Create some stereochemistry models showing , sawhorse and fischer projections using the materials available in your home.

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), SALEM – 7

M. Sc CHEMISTRY

FIRST SEMESTER

CORE COURSE : PHYSICAL CHEMISTRY - I

COURSE CODE : 17PCH02 [75 Hours]

Learning Objectives:

- **To know classical aspects of thermodynamics**
- **To understand the speed of the chemical reactions**
- **To study the fundamentals of group theory**
- **To study fundamental ideas about quantum chemistry**

Learning outcome :

- **Get introduced about thermodynamical aspects of chemical reactions**
- **Know the theoretical aspects of quantum mechanics**
- **Understood the relation between shape and properties through group theory**
- **Got introduced the relation between surface , rate and catalysis**

UNIT- I Classical Thermodynamics and Phase Equilibrium (15 Hours)

Partial molar properties - Gibbs – Duhem equation- Partial molar free energy (Chemical Potential) – Determination of chemical potential [Direct method and Method of Intercepts] and partial molar volume – variation of chemical potential with Temperature and Pressure – application of phase rule to three component systems involving solids and liquids ($CH_3COOH – CHCl_3 – H_2O$, $NaCl – Na_2SO_4 - H_2O$).

UNIT – II Chemical Kinetics-I (15 Hours)

Theories of Reaction rates – Arrhenius theory – effect of temperature on reaction rate – Hard – Sphere collision theory of reaction rates – molecular beams – collision cross section – effectiveness of collisions – Probability factor.

Transition state theory of reaction rates - Potential energy surface – Partition functions and activated complex – Eyring equation - Comparison of results with Eyring and Arrhenius equations – Estimation of free energy, enthalpy and entropy of activation, significance and problems.

UNIT – III Quantum Chemistry –I (15 hours)

Black body Radiation: Experimental results of Black body radiation. Specific Rayleigh Jeans law, Wien's displacement law and Plancks equation. Photoelectric effect: De Broglie equation and its significance – Heisenberg uncertainty principle – Compton effect and its significance. Operators – quantum mechanical postulates – Schordinger wave equation for time dependent and independent equations and its application for particle in one dimensional, three dimensional box - problems. Particle in a box with finite potential barrier and tunneling.

UNIT –IV Group Theory (15 hours)

Symmetry elements and symmetry operations – Point groups – identification and representation of groups – comparison of Molecular symmetry with Crystallographic symmetry – Reducible and irreducible representation – Direct product representation – Great orthogonality theorem and its consequences – Character Table construction (C_2v,C_3v)and their uses. Symmetry selection rules for vibrational, electronic and Raman's spectra. Determination of representation of vibrational modes in non- linear molecules such as H_2O, CH_4, XeF_4, SF_6 and NH_3. Symmetry of Hybrid orbitals in non-linear molecule (BF_3, CH_4, XeF_4, PCl_5, and SF_6).

UNIT –V Surface Chemistry and Catalysis [15 Hours]

Kinetics of surface reactions : Physical and chemical adsorption – adsorption isotherms – types of adsorption isotherms – Langmuir adsorption isotherm – B.E.T. theory for multilayer adsorption – application of transition state theory to adsorption – measurement of surface area – Mechanism of heterogeneous catalytic reactions – the adsorption coefficient and its significance.

Acid – Base catalysis – mechanism – Bronsted catalysis Law – catalysis by enzymes – rate of enzyme catalysed reactions – Michaelis Menten equation. Effect

of substrate concentration, pH and temperature on enzyme catalysed reactions – inhibition of enzyme catalyzed reactions.

Text Books :

1. S. Glasstone, Thermodynamics for chemists, Affiliated East West press, New Delhi, 2008.
2. J. Rajaram and J.C. Kuriacose, Thermodynamics for students of chemistry, pearson education, New Delhi,2006.
3. J.Rajaram and J.C.Kuriacose, Kinetics and mechanism of chemical transformation, Macmillan India Ltd.,2000.
4. K.J.Laidlar, Chemical kinetics, pearson education, 2016.
5. D.A. Mcquarrie, Quantum chemistry, Virat siva student education (2016)
6. R.K.Prasad, Quantum chemistry, New age science, New Delhi,2009.
7. V.Ramakrishnan and M.S. Gopinathan, Group Theory in chemistry, Vishal Publications,2013.
8. K.V.Raman, Group theory and its application to chemistry, Tata McGraw Hill Publishing Co., 1990.

Reference Books;

1. W.J.Moore, Physical chemistry, 5th edition, Orient Longman, London,1999
2. K.G. Denbeigh, Thermodynamics of Steady State, Meklien and Co. Ltd., London,1951
3. L.K.Nash, Elements of Chemical Thermodynamics, Addison Wesley,1962
4. R.G.Frost and Pearson, Kinetics and Mechanism, Wiley New York,1961
5. J.W.Moore and R.G. Pearson, Kinetics and Mechanism,1981
6. C.Capellos and B.H.J.Bielski, Kinetic systems, Willey interscience, New York, 1968
7. G.M.Harris, Chemical Kinetics, D.C. Heath and Co,1966
8. I.N.Levine, Quantum Chemistry, Allyn and Bacon, Boston,1983
9. J.Goodman, Contemporary Quantum Chemistry, An Introduction, Plenum Press, Newyork,1977.
10. F.J.Bockhoff, Elements of Quantum Theory, Addision Wesley, Reading , Mass,1976

11. P.W.Atkins, Physical Chemistry, Oxford University press, Oxford. 1990.
12. P.W.Atkins, Molecular Quantum Mechanics, Oxford University press, Oxford,1983
13. H.Eyring, J,Walter and G.Kimball, Quantum chemistry, John Wiley and sons, New York,1944.
14. L.S.Pauling and E.B.Wilsob, Introduction to Quantum Mechanics, McGraw Hill book co, New York,1935.

Task :

1. create models explaining the various symmetry elements in your home.
2. Search some plant leaves around your home that shows symmetry elements in them and identify.

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) , SALEM – 7

M. Sc CHEMISTRY

FIRST SEMESTER

ELECTIVE COURSE : ADVANCED INORGANIC CHEMISTRY

COURSE CODE : 17PCHM1 [75 Hours]

Learning Objectives:

- To study bonding in inorganic chemistry
- To understand the stereochemistry of inorganic complexes
- To explore non conventional sources of energy
- To study fundamental ideas about supramolecular chemistry

Learning outcome :

- Learned basic ideas about bonding in inorganic complexes
- Studied about spacial arrangement of groups around metal atom
- Got knowledge about non conventional energy resources
- Studied about supramolecular chemistry

UNIT –I Structure and bonding (15Hours)

Van der Walls bonding, Hydrogen bonding and applications, Hard and Soft acids and bases-classification, Acid-Base strength, hardness, Symbiosis, Theoretical basis of Hardness and Softness, applications of HSAB.

Polyacids – Isopolyacids of V, Cr, Mo and W; Heteropolyacids of Mo and W (only structural aspects).

Inorganic polymers – Silicates – structure, Paulings rule, Properties, correlation and application; Molecular sieves.

Rings – Phosphazenes – Structure, Craig and Peddock model, Dewar model, polyorganophosphazenes, Polysulphur –nitrogen compounds.

UNIT – II Stability and stereo chemical aspects of complexes (15Hours)

Stability of complexes – Factors affecting stability of complexes, thermodynamic aspects of complex formation, Stepwise and overall formation constants, stability correlations, statistical and chelate effects; Determination of stability constant – polarographic, photometric and potentiometric methods.

Stereochemical aspects – Stereoisomerism in inorganic complexes, isomerism arising out of ligand distribution and ligand conformation, chirality and nomenclature of chiral complexes; application of ORD and CD in the identification of chirality of complexes.

Macrocyclic ligands – types – porphyrins, corrins, Schiff's bases, crown ethers and cryptates (simple complexes).

UNIT-III Nuclear Chemistry (15Hours)

Nuclear properties –features of the liquid drop and the shell models of the nucleus; Modes of radioactive decay-orbital electron capture, nuclear isomerism, internal conversion, Detection and Determination of activity – Nuclear emulsion, Cloud and bubble chamber, GM counter, Scintillation and Cherenkov counters, Radiation protection and safety precautions,

Nuclear reactions – Types natural and accelerated particle, transmutation, reaction cross section, Q-value, threshold energy, compound nuclear theory. Direct reactions, photonuclear and thermo nuclear reactions. Stellar energy.

Applications : Neutron activation analysis, Radio pharmacology, Isotope dilution analysis., radiation dosimetry, radiolysis of water, hydrated electron.

UNIT-IV

Supramolecular Chemisrty and nano materials [15 hours]

Concept of supramolecular Chemistry, molecular recognition, design of supramolecule through non covalent interactions and their applications in transport processes.

Nano Materials :

Definition and types of nano-materials, Importance of nano-materials ,

Size dependent properties, Various techniques for making nano-materials (Arc., sol-gel, vapour deposition, chemical methods), characterization tecnhiques. Applications of nano-materials. Carbon nano tubes and its applications.

UNIT-V

Nonconventional energy sources [15 hours]

Solar sources: Photochemical methods, thermodynamic efficiency of energy conversion, energy from solar radiations, transition metal complexes for energy production, solar hydrogen system, photochemical processes at semiconductor electrodes, photo-galvanic and photovoltaic cells based on inorganic photochemical systems – energy derived from nuclear fusion and fission reaction.

Text books

1. H.J.Emelius and Sharpe, Modern aspects of Inorganic chemistry, Universal book Stall, New Delhi, 1989.
2. J.E.Huheey, E.A.Keiter and R.L Keiter, Inorganic Chemistry –Principles of structure and reactivity, 4th edition, Pearson-Education, 2006.
3. F.A.Cotton and G.Wilkinson, Advanced Inorganic Chemistry, Wiley Eastern, 6th edition, 1999.
4. F.Basolo and R.G.Pearson, Mechanism of Inorganic reactions, Wiley Eastern, 1967.
5. S.Glasstone, Source book of Atomic Energy, Van Nonstrand Co., 2012.
6. H.J.Arniker, Essentials of nuclear chemistry, 2nd edition Wiley eastern Co., 2011.
7. R.S.Drago, Physical Methods in Chemistry, Reinhold, New York, 2012.
8. Charles A. Depuy and Orville L.Chapman, Molecular reactions and Photochemistry, Prentice Hall, 1992.
9. A.W. Adamson and P. Fleischuer, Concepts of Inorganic Photochemistry, Wiley, 1975.
10. R.C. Kapoor and B.S. Agarwal, Principles of polarography, Wiley Eastern Ltd., 1991.

Reference Books

1. K.F.Purcell and J.C.Kotz, Inorganic Chemistry, WB Saunders Co., USA, 2015.
2. G.S.Manku, Inorganic Chemistry, TMH Co., 2015.
3. A.K.Srivastsava and P.C.Jain, Elements of Nuclear Chemistry, S.Chand and Co., 1989.

4. Nanomaterials. An introduction to synthesis, properties and applications, Dieter vollath, Second edition , Wiley interscience, 2013.
5. Introduction to nanomaterials and devices, Omar manashreh, Wiley,2013.
6. Non-Conventional Resources of Energy, Sawney, ELBS, 2012.
7. Energy resources, G.D.Rai, kanna publications, 2014.
8. Core concepts in supramolecular and nanomaterials chemistry, J.W steed, turner, Wallace, John Wiley, 2007.
9. Supra molecular chemistry-Fundamentals and applications, Katsuhiko Ariga · Toyoki Kunitake, Springer, 2006.
10. G.Friedlander, J.W Kennedy and J.M. Millker, Numclear and Radiochemistry, Wiley, 1964.
11. Willard Merit, Dean and settle, Instrumental menthods of analysis, CBS publishers and distributers, 4th edition, 1989.
12. G.D.Christian and J.E.O Reiley, Instrumental Analysis, Allyn road and Kacon Inc. II edn. 1986.

Task :

1. make a model that use solar energy to go your home application like cooking and other purposes.
2. Search and find naturally available nanomaterials in internet and collect information about them.

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) , SALEM – 7

M. Sc CHEMISTRY

FIRST SEMESTER

ELECTIVE COURSE : POLYMER CHEMISTRY

COURSE CODE: 13PCHM1

[75 Hours]

OBJECTIVES

- To study the basic concepts in polymer chemistry.
- To learn about the kinetics and types of co-ordination polymerization.
- To study the measurement of molecular weight and the properties of polymers.
- To study about the polymer processing and properties of commercial polymers.

UNIT – I Basic Concepts (15Hours)

Monomers, repeat units, degree of polymerization, Linear, branched and network Polymers. Condensation Polymerization : Mechanism of stepwise polymerization. Kinetics and statistics of linear stepwise polymerization. Addition polymerization : Free radical, cationic and anionic polymerization. Polymerization conditions. Polymerization in homogeneous and heterogeneous systems.

UNIT – II Co-ordination Polymerization (15 Hours)

Kinetics, mono and bimetallic mechanism of co-ordination polymers. Zeigler Natta catalyst, co-polymerization: Block and graft co-polymers, kinetics of copolymerization. Types of co-polymerization. Reactivity ratio.

UNIT – III Molecular Weight and Properties (15 Hours)

Polydispersion – average molecular weight concept, number, weight and viscosity average molecular weights. Measurement of molecular weights. Viscosity, light scattering, osmotic and ultracentrifugation methods. Polymer structure and physical properties – crystalline melting point Tm. The glass transition temperature. Determination of Tg. Relationship between Tm and Tg.

UNIT – IV Polymer Processing (15 Hours)

Plastics, elastomers and fibres. Compounding, processing techniques: calendering, die casting, rotational casting, film casting, injection moulding, blow moulding extrusion, moulding, thermoforming, foaming, reinforcing and fibre spinning.

UNIT – V Properties of Commercial Polymers (15 Hours)

Polyethylene, polyvinyl chloride, polyamides, polyesters, phenolic resins, epoxy resins and silicone polymers. Functional polymers, Fire retarding polymers and electrically conducting polymers. Biomedical polymers – contact lens, dental polymers, artificial heart, kidney, skin and blood cells.

Text Books

1. F.W. Billmeyer, TextBook of Polymer Science, 3rd Edition, J.Wiley, 2003.

2. V. R. Gowariker, N.V. Viswanathan and J. Sreedhar, Polymer Science, New Age Int., 1986.

Reference Books

1. H.R. Alcock and F.W. Lamber, Contemporary Polymer Chemistry, Prentice Hall, 1981.

2. P.J. Flory, Principles of Polymer Chemistry, Cornell University press, New York, 1953.

3. G. Odian, Principles of Polymerization, 2nd Edition, John Wiley & Sons, New York, 1981.

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) , SALEM – 7

M. Sc CHEMISTRY

SECOND SEMESTER

CORE COURSE : ORGANIC CHEMISTRY - II

COURSE CODE : 17PCH03 [75 Hours]

Learning Objectives:

- **To study about eliminations reactions in organic chemistry**
- **To get knowledge on aromatic chemistry and its properties**
- **To study electrophilic and nucleophilic substitution reactions of aromatics**
- **To know about pericyclic and conformational analysis of simple compounds**

Learning outcome :

- **Detailed study of elimination reactions has been carried out**
- **Got introduced on aromatic system and its substitution reactions**
- **Studied about pericyclic reactions**
- **Got basic idea on simple organic molecular energies and reactions.**

UNIT – I Elimination Reactions [15 Hours]

E1, E2, E1CB mechanisms, Orientation of the double bond-Hofmann and Saytzeff rule, competition between elimination and substitution, dehydration and dehydrohaloganation reactions, stereochemistry of E2 eliminations in cyclohexane ring systems, mechanism of pyrolytic eliminations, Chugaev reaction and Cope elimination.

UNIT II Aromaticity and Organic Photo chemistry [15 Hours]

Aromaticity of benzenoid, heterocyclic and non-benzenoid compounds, Huckel rule, aromatic systems with π electron compounds other than six π electrons, non-aromatic (cyclooctatetraene, etc.,) and anti aromatic systems (cyclobutadiene, etc.,),

Aromaticity of systems with more than 10 π electrons: annulenes, hetero annulenes, azulenes and fullerenes (C_{60}) .

Photochemical reactions: Norrish Type I and Norrish Type II reactions, photoreduction of ketone, photoaddition reactions, Paterno Buchi reaction, di-pi methane rearrangement, photochemistry of arenas, Photooxidation (Formation of peroxy compounds), Photoisomerization (Cis-trans isomerization), problems.

UNIT III Aromatic electrophilic and nucleophilic substitution reactions. [15 Hours]

The arenium ion mechanism, typical reactions like nitration, sulphonation, haloganation, Friedal-Crafts alkylation, acylation and diazonium coupling, electrophilic substitution on monosubstituted benzene, orientation and reactivity-ortho, meta and para directing groups, ortho-para ratio, ipso attack, Gatterman, Gatterman-koch, Vilsmeir, Reimer-Tiemann reaction. Aromatic nucleophilic substitution reactions, the S_NAr, S_N1, $S_{RN}1$ mechanisms, the aryl cation mechanism, the benzyne intermediate mechanism, aromatic nucleophilic substitution of activated halides-Ziegler alkylation, Chichibabin reaction- problems

UNIT IV Stereochemistry and Conformational Analysis [15 Hours]

Stereospecific and stereoselective synthesis with suitable examples, asymmetric synthesis – Crams rule, newer method of asymmetric synthesis including enzymatic and catalytic nexus, enantio and diastereo selective synthesis, conformational analysis of simple cyclic (chair and boat cyclo hexanes) and acyclic (n-butane) systems, conformation of simple 1,2 disubstituted derivatives – ethylene chlorohydrin and ethylene glycol, Conformational analysis and stereochemical features of disubstituted cyclohexanes (1,2 ; 1,3 ; 1,4 dialkyl cyclo hexanes), conformation and stereochemistry of cis and trans decalins, problems.

UNIT V Pericyclic reactions [15 Hours]

Pericyclic reactions, classification, orbital symmetry, Woodward Hofmann rules, selection rules. Cycloaddition reactions: reaction of anions and cations, intramolecular, reactions involving more than six electrons, allowed and forbidden cycloadditions, regioselectivity and stereochemistry. Cheletropic reactions. Electrocyclic reactions: thermal photochemical and ionic conjugated electrocyclic reactions., sigmatropic and

group transfer reactions. Analysis by correlation diagram method and Frontier molecular orbital method, Sommelet, Hauser, Cope and Claisen rearrangements, problems.

Text Books

1. Jerry March, Advanced Organic Chemistry- Reactions, Mechanisms and Structure, Fourth Edition, John Wiley & Sons 7th edition.(2015)
2. Francis A. Carey, Organic Chemistry, Third Edition, The McGraw-Hill Companies, Inc., 8th edition, 2015.
3. P. S. Kalsi, Organic Reactions and Mechanisms, Second Edition, New Age International Publishers, 2002.
4. Ernest L. Eliel, Stereochemistry of Carbon Compounds, T.M.H Edition, Tata McGraw-Hill Publising Company, 2001.
5. P. S. Kalsi, Stereochemistry – Conformation and Mechanism, 6th Edition, Wiley Eastern Limited, 2005.
6. I.L. Finar, Organic Chemistry, Volume. II, Fifth Edition, First Indian reprint, Pearson Education Asia Pvt. Ltd., (2002)

Reference Books

1. S.H.Pine, J.B. Hendrickson, D.J.Cram and G.S.Hammond, Organic Chemistry, IV Edn. McGraw-Hill Company 1980.
2. P.S.Kalsi, Organic Reactions and Mechanisms, II Edn. New Age International Publishers, 2000.
3. P.S. Kalsi, Stereochemistry and Mechanism through solved problems, Third Edition, New Age International Publishers, 2006.
4. D. Nasipuri, Stereochemistry of Organic Compounds, 3rd Edition, New Age International Publishers, 2011.
5. S.M.Mukherji and S.P.Singh, Reaction Mechanism in Organic Chemistry, Macmillan, 1st Edn., 1976.
6. R.T.Morrison and R.N.Boyd, Organic Chemistry, 6th Edn., Prentice-Hall,1992.
7. R.O.C. Norman, Principles of Organic Synthesis, 3rd Edition, Chapman and Hall, 1993

Task :

1. collect the MDQ questions pertaining to the pericyclic reactions asked in various competitive exams.
2. Collect information on the scientist whose name is appear in named reaction. Like Friedal crafts and chichibabin etc.,,

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) , SALEM – 7

M. Sc CHEMISTRY

SECOND SEMESTER

CORE COURSE : INORGANIC CHEMISTRY-I

COURSE CODE : 17PCH04 [75 Hours]

Learning Objectives:

- **To study about boron compounds and clusters**
- **To gain knowledge on metal -ligand bonding**
- **To study on solid state structure and properties of inorganic chemicals**
- **To study various spectral techniques on inorganic compounds**

Learning outcome :

- **Gained knowledge on boron compounds and clusters**
- **Studied on Metal- ligand boning in inorganic chemistry**
- **Gained knowledge on various solids and crystal structure**
- **Gained knowledge on spectral applications of inorganic complexes**

UNIT-I Boron compounds and Clusters (15Hours)

Boron hydrides – polyhedral boranes, hydroborate ions – a general study of preparation, properties and structure, styx numbers, Wade's rules.

Carboranes –types such as closo and nido – preparation, properties and structure.

Metallo carboranes – a general study.

Metal clusters –Chemistry of low molecularity metal clusters only –structure of $Re_2Cl_8^{2-}$, metal-metal multiple bonds.

UNIT-II Metal-Ligand Bonding (15Hours)

Crystal field theory –Splitting of d-orbitals under various geometrics, factors affecting splitting, CFSE, evidences for CFSE (Structural and thermodynamic effects), Spectrochemical series, John-Teller distortion –Dynamic and static John-Teller effect, John-Teller effect and Chelation; Limitations of CFT; Evidence for metal-ligand overlap;

M.O. Theory and energy level diagrams, concept of weak and strong fields, sigma and pi bonding in complexes, Nephelauxetic effect.

UNIT-III Solid – State Chemistry (15Hours)

Crystal Structure: Crystalline and amorphous solids; crystal systems, point groups: methods of characterizing crystal structure - Powder x-ray diffraction, electron and neutron diffraction; types of close packing - hcp and ccp, packing efficiency, radius ratios; structure types - Na_2O, $CdCl_2$, wurtzite, nickel arsenide, CdI_2, rutile and , Cs_2O, perovskite ABO_3, spinels, fluorites and antifluorites

Preparative methods: Solid state reaction, chemical precursor method, co-Precipitation, Solgel, ion exchange reactions, Intercalation / deintercalation reactions hydrothermal and template synthesis; High pressure synthesis.

UNIT-IV Properties of Solids (15Hours)

Electrical properties of solids – Band Theory, semiconductors, super conductors, solid state electrolytes; Magnetic properties – dia, para, ferro, antiferro and ferrimagnetism; hysteresis; ferrites; garnets; Optical properties –solid state lasers and Inorganic phospors. Reactions in solid state and phase transitions – diffusion coefficient, diffusion mechanism, vacancy and interstitial diffusions, solid solutions, order-disorder transformations. Liquid crystals : types and properties

UNIT-V Spectral applications in inorganic chemistry (15Hours)

Combined uses of IR and Raman spectra in the structural elucidation of simple molecules like N_2O, CIF_3, NO_3, ClO_3, NSF_3. Effect of coordination on ligand vibrations, use of group vibrations in the structural elucidation of metal complexes of Urea, Thiourea, Cyanide, Thiocyanate, Nitrate, Sulphate and Dimethylsulphoxide. Effect of isotopic substitution on the vibrational spectra of molecules, vibrational spectra of metal carbonyls with reference to the nature of bonding, geometry and number of C-O stretching vibrations, Group theoretical treatment for C_2V molecules, limitations of IR.

Text books

1. J.E. Huheey, E.A. Keiter and R.L.Keiter, Inorganic Chemistry –Principles of structure and reactivity, 4th edition, Pearson-Education, 2006.

2. F.A.Cotton and G.Wilkinson, Advanced Inorganic Chemistry, Wiley Eastern, 6th edition, 1999.
3. R.S.Drago, Physical Methods in Chemistry, Reinhold, New York, 2014.
4. D.M. Adams, Inorganic solids, John Wiley Sons, 1974.
5. R.West, Basic solid State Chemistry, John Wiley Sons, 1998.
6. W.E. Addison, Structural Principles in Inorganic Chemistry, Longman, 1961.
7. E.A.V. Edsworth, D.W.H. Rankine and S.Craddock, Structural methods in Inorganic Chemistry, Black well Scientific Pbn., 1987.
8. D. A. Skoog, Principles of Instrumental Analysis, Cencaer learning, 5th Edn., 2012.
9. Shriver and Atkins, Inorganic chemistry, 5th edition, Oxford university press, 2010.

Reference Books

1. E.L.Mutteri, Polyhedral boranes, Academic press, NY, 1975.
2. N.H.Ray, Inorganic polymers, Academic press, NY, 1975.
3. K.F.Purcell and J.C.Kotz., Inorganic Chemistry, WB Saunders Co., USA 1977.
4. G.S.Manku, Inorganic Chemistry, TMH Co., 1984.
5. A.R.West, Solid-State Chemistry and its applications, Wiley, New York 1984.
6. A.Muller, Inorganic Structural Chemistry, Wiley, New York, 1993.
7. C.N.R.Rao and J.R.Ferraro, Spectroscopy in Inorganic Chemistry, Vol. I and Vol.II, Academic Press, 1970.
8. H.A.O.Hill and P.Day, Physical methods in Advanced Inorganic Chemistry, John Wiley, 1986.
9. L. Smart and E. Moore, Solid State Chemistry - An Introduction, Chapman & Hall, 1992.
10. H. V. Keer, Principles of the Solid State, Wiley Eastern Limited, 1993.
11. K. Chakrabarty, Solid State Chemistry, New Age Publishers, 1996.

Task :

1. Make a model of various crystal system with the material available nearby.

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) , SALEM – 7

M. Sc CHEMISTRY

SECOND SEMESTER

CORE COURSE : PHYSICAL CHEMISTRY - II

COURSE CODE : 17PCH05 **[75 Hours]**

Learning Objectives:

- **Detailed study on classical thermodynamics.**
- **To study on fast reactions and isotopic effect of chemical kinetics**
- **To study quantum mechanical aspects of chemistry**
- **To gain knowledge on fate of an excited electrons**

Learning outcome :

- **Studied about boron compounds and clusters**
- **A knowledge on fast reactions and isotopic utilization on chemical kinetics.**
- **Quantum chemistry electronic states have been studied**
- **Gained knowledge on photophysical processes of excited electrons**

UNIT –I Classical and irreversible Thermodynamics [15 Hours]

Thermodynamics of ideal and real gases, gas mixtures – Fugacity- definition –Methods of determination of fugacity –Variation of fugacity with temperature and pressure.

Standard states for gases, liquids, solids and components of solutions – Excess function for non-ideal solution and their determination – determination of activities and activity coefficient from Vapour pressure, Freezing point, and EMF-measurements, Solubility measurements.

Solution of Electrolytes – mean ionic activity, mean ionic molality and mean ionic activity coefficients – Concept of ionic strength. Irreversible Thermodynamics: entropy production, forces and fluxes, Onsager reciprocal relations

UNIT – II Chemical Kinetics – II [15 Hours]

Reactions in solutions – the influence of solvent, ionic strength, dielectric constant and pressure on reaction in solution- Kinetic isotope effects- Linear free energy relationship – Hammett and Taft equations. General treatment of chain reaction – Chain length- Rice Herzfeld mechanism – explosion limits.

Study of Fast reactions : Study of kinetics by relaxation methods (temperature and pressure jump methods), stopped flow technique, flash photolysis and magnetic resonance method.

UNIT –III Quantum Chemistry –II [15 Hours]

Schrodinger equation for the rigid rotator, Hydrogen atom and simple harmonic oscillator – arriving solution for energy and wave function – the origin of quantum numbers and their physical significance – Probability distribution of electrons.

Born-Oppenhiemer approximation – One electron orbitals. Pauli's antisymmetry principle – Slatter determinant for G.S and E.S for helium atom. Slatter type orbitals and rules

UNIT - IV Photophysical processes [15 Hours]

Photo physical processes of electronically excite state – Jablonski diagram – spin allowed and spin forbidden – radioactive and non- radioactive processes.

Fluorescence and Phosphorescence – Theory of Fluorescence and Phosphorescence. Factors affecting Fluorescence and Phosphorescence, quenching of Fluorescence – static and dynamic quenching – Stern – Volmer equation. Excimer Exciplex formation and decay. lifetime and quantum yield calculation, Stokes shift.

Photovoltaic cell and Photoelectrochemical cells - Photogalvanic cells – photoassisted electrolysis of water – solar energy conversion. Photoredox, photoisomerisation and photo rearrangement reactions in inorganic complexes.

UNIT –V Spectroscopy –I (15 Hours)

Interaction of matter with radiation – Einstein's theory of transition probability – Rotation spectroscopy – Rigid Rotor – Intensity of spectral lines – Molecular parameters from Rotation spectra – Effect of isotopic substitution on the rotation spectra. Vibrational spectroscopy – harmonic oscillator – anharmonic oscillator – Hot bands – selection rules – Vibrational spectra of Polyatomic molecules- Overtones and combination frequencies – Fermi Resonance.

Raman spectroscopy – Raman effect – Rotational and vibrational Raman Spectra – Mutual Exclusion Rule. Electronic spectroscopy - Electronic spectra of diatomic molecules- vibrational coarse structure – Franck – Condon Principle.

Text Books :

1. S.Glasstone, Thermodynamics for chemists, Affiliated East west press, New Delhi (1960)
2. J.Rajaram and J.C.Kuriacose, Thermodynamics for students of Chemistry, Lal Nagin chand, New Delhi (1986)
3. J.Rajaram and J.C.Kuriacose, Kinetics and mechanism of chemical transformation, Macmillan India Ltd., (1993)
4. K.J.Laidlar, Chemical kinetics, Harper and Row, New York (1987)
5. R.K.Prasad, Quantum chemistry, Wiley Eastern, New Delhi (1992)
6. M.W.Hanna, Quantum mechanics in chemistry, W.A.Benjamin INC, London (1965)
7. Charles H. DePuy, Molecular Reactions and Photochemistry, Orville L. Chapman, Prentice Hall of India Private Limited, New Delhi, 1988.
8. R. Hasse, Thermodynamics of Irreversible Process, Addison Wesley, Reading, 1969
9. Y. R. Sharma, Elimentary Organic Spectroscopy, 1st Edn., S. Chand & Company Ltd, New Delhi, 1980.J

10. J. Dyer, Application of absorption spectroscopy of organic compounds, Prentice Hall of India Pvt. Ltd., New Delhi, 2005

Reference Books :

1. W.J.Moore, Physical chemistry, Orient Longman, London (1972)
2. K.G.Denbeigh, Thermodynamics of Steady State, Meklien and co. Ltd.,London (1951)
3. L.K.Nash, Elements of Chemical Thermodynamics, Addison Wesley (1962)
4. R.G.Frost and Pearson, Kinetics and Mechanism, Wiley New York (1961)
5. J.W.Moore and R.G.Pearson, Kinetics and Mechanism (1981)
6. C.Capellos and B.H.J.Bielski, Kinetic systems, Willey inter science, New York (1968)
7. G.M.Harris, Chemical Kinetics, D.C.Heath and co, (1966)
8. A.K.Chandra, Introductory Quantum Chemistry, Tata Mc Graw Hill
9. D.A.Mc Quarrie, Quantum Chemistry, University science books, Mill Valley, California (1983)
10. P.W.Alkins, Molecular Quantum Mechanics, Oxford university press, Oxford (1983)
11. I.N.Levine, Quantum Chemistry, Allyn and Bacon, Boston (1983)
12. F.J.Bockhoff, Elements of Quantum Theory, Addison Wesley, Reading, Mass (1976)
13. H.Eyring, J.Walter and G.Kimball, Quantum Chemistry, John wiley and Sons, New York (1944)
14. L.S.Pauling and E.B.Wilsob, Introduction to Quantum Mechanics, McGraw Hill book co, New York (1935)
15. C.N.Banwell, Fundamentals of Molecular Spectroscopy, McGraw Hill, New York,1966.
16. G.M.Barrow, Introduction to Molecular Spectroscopy, McGraw Hill, NewYork,1962.

Task:

1. Search fluorescent and phosphorescent dyes used in materials that are used day today.
2. Make a model of photovoltaic cells

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), SALEM – 7

M. Sc CHEMISTRY

FIRST YEAR

CORE PRACTICAL : ORGANIC CHEMISTRY PRACTICAL-I

COURSE CODE : 17PCHP1 [90 Hours]

PART I ORGANIC PREPARATION

1. Beta naphthyl methyl ether from beta naphthol
2. s–Benzyl isothiuronium chloride from benzyl chloride
3. Beta glucose penta acetate from glucose
4. ortho- Benzoyl benzoic acid from phthalic anhydride
5. Resacetophenone from resorcinol
6. para- Nitrobenzoic acid from para- nitrotoluene
7. meta - Nitroaniline from meta - dinitrobenzene
8. Methyl orange from sulphanilic acid
9. Anthraquinone from anthracene
10. Benzhydrol from benzophenone

PART II. ORGANIC ANALYSIS

Identification of components in a two component mixture and preparation of their derivatives. Determinations of boiling point/melting point for components and melting point for their derivatives.

Reference:

Laboratory manual of organic chemistry – B. B. Dey, M. V. Sitaraman

Text book of Practical Inorganic Chemistry – Edited by Vogel, ELBS, London.

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), SALEM – 7

M. Sc CHEMISTRY

FIRST YEAR

CORE PRACTICAL: INORGANIC CHEMISTRY PRACTICAL-I

COURSE CODE : 17PCHP2 [90 Hours]

PART –I INORGANIC SEMIMICRO QUALITATIVE ANALYSIS

Semimicro qualitative analysis of inorganic mixtures containing two common and two rare cations. The inorganic compounds containing the following rare cations : W, Tl, Mo, Te, Se, Ce, Th, Be, Zr, V, U and Li may be given for analysis.

PART – II INORGANIC PREPARATION

a) Preparation of the following :
   i. Potassium trioxalatoaluminate (III) trihydrate
   ii. Tris(thiourea)copper (I) chloride
   iii. Potassium trioxalatochromate (III) trihydrate
   iv. Sodium bis (thiosulphato) cuprate (I)
   v. Tetramminecopper (II) sulphate
   vi. Potassium Tetrachlorocuprate (II)

b) Separation of mixture of two metal ions by paper chromatography.

(Not for semester examination)

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) , SALEM – 7

M. Sc CHEMISTRY

FIRST YEAR

CORE PRACTICAL: PHYSICAL CHEMISTRY PRACTICAL-II

COURSE CODE : 17PCHP3 [90 Hours]

LIST OF EXPERIMENTS

Typical list of possible experiments are given. Experiments of similar nature and other experiments may also be given. The list given is only a guideline. A minimum of 15 experiments have to be performed in a year.

1. Study the kinetics of acid hydrolysis of an ester, determination of the temperature coefficient of the reaction and determination of the activation energy of the hydrolysis of ethylacetate.

2. Study the kinetics of the reaction between acetone and iodine in acidic medium by half life method and determine the order with respect to iodine and acetone.

3. Study of the saponification of ethylacetate by sodium hydroxide conductometrically and determine the order of the reaction.

4. Determination of association of ethylacetate by sodium hydroxide conductomertically and determine the order of the reaction.

5. Study the phase diagram for m-toluidine and glycerine system.

6. Construction of phase diagram for a simple binary system (naphthalene-phenanthrene and benzophenone-diphenylamine).

7. Construction of the phase diagram of the three component of partially immiscible liquid systems (DMSO-Water-Benzene; Water-Benzene-Acetic acid; Ethyl alcohol-Benzene-Water; Acetone-Chloroform-Water; Chloroform-Acetic acid-Water).

8. Determination of the equilibrium constant of the reaction between Iodine and KI by partition method.

9. Determination of equivalent conductance of a weak acid at different concentrations and verify Ostwald's dilution law and calculation of the dissociation constant of the acid.

10. Determination of equivalent conductivity of a strong electrolyte at different concentrations and examine the validity of the Onsager's theory as limiting law at high dilutions.

11. Conductometric titrations of a mixture of HCl and CH_3COOH against Sodium hydroxide

12. Compare the relative strength of acetic acid and monochloroacetic acid by conductivity method.

PART-III SPECTROPHOTOMETRY

Colorimetric analysis : Determination of Iron, Nickel and Copper

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) , SALEM – 7

M. Sc CHEMISTRY

SECOND YEAR

THIRD SEMESTER

CORE COURSE – VII : ORGANIC CHEMISTRY - III

COURSE CODE : 17PCH06 [75 Hours]

Learning Objectives:

- **To study the reactions of C=C and C=X**
- **To study the rearrangements**
- **To study various synthetic utility of organic reagents**
- **To study oxidation and reduction chemistry**

Learning outcome :

- **Reactions of C=C and C=X are studied**
- **Gained knowledge on molecular rearrangements**
- **Gained on synthetic utility of various organic reagents**
- **Gained knowledge on peptides and biologically important molecules**

UNIT-I Addition to Carbon-Carbon and Carbon-Hetero atom multiple bonds [15 Hours]

Addition of halogen and nitrosyl chloride to olefins, hydration of olefins and acetylenes, hydroboration, hydroxylation, epoxydation, Michael addition, 1,3 dipolar addition, carbenes and their additions, Diels-Alder reaction and Reverse Diels-Alder reaction.

Mechanism and reactivity : Mannich, Stobbe, Darzen Glycidic ester condensation, Benzoin condensation, Peterson olefination(Silyl Wittig reaction), Strecker synthesis, Wittig, Wittig-Horner, Perkin , Thorpe , Ritter ,Prins reactions.

UNIT II Molecular Rearrangements [15 Hours]

A detailed study of the mechanism of the following rearrangements: Nucleophilic, Electrophilic and Free radical rearrangements- memory effects, migratory aptitudes, Pinacol-Pinacolone, Wagner - Meerwin, Demyanov, Dienone - Phenol, Favorski, Baeyer

- Villiger, Wolff, Stevens, Von-Richter, Clasien, Hofmann, [1,2] and [2,3]-Meisenheimer, Smiles, Sommelet–Hauser, [1,2] and [2,3] Wittig rearrangements (a few examples in each rearrangement are to be studied).

UNIT III Reagents in Organic Synthesis [15 Hours]

Synthesis of simple organic molecules using standard reactions like acylation and alkylation of enamines and active methylene compounds. Sulphur ylides, Robinson ring annulation, protection and deprotection of functional groups (R-OH, R-CHO, RCOR, R-NH_2 and R-COOH) Reagents and their uses: DCC, Dess Martin Periodinane(DMP) trimethyl silyl chloride, 1,3-dithiane (umpolung), diisobutylaluminium hydride (DIBAL), 9BBN, DBU

UNIT IV Oxidation and Reduction Reactions [15 Hours]

Study of the following oxidation reactions with mechanism: Oxidation of alcohols by CrO_3, DMSO alone, DMSO in combination with DCC; acetic anhydride and oxalyl chloride, oxidation of arylmethane, oxidation of methylene alpha to carbonyl, allylic oxidation of olefins, oxidative cleavage of glycols, oxidative cleavage of double bonds by ozonolysis. Sharpless asymmetric epoxidation and dihydroxylation, Jacobson epoxidation, prevost reaction and woodward modification.

Study of the following reduction reactions with mechanism: Reduction of carbonyl compounds by hydrides, selectivity in reduction of 4-ter-butyl cyclohexanone using selectrides, Clemmensen and Wolff Kishner reductions, Birch reduction, MPV reduction.

UNIT V Steroids and Bioorganic Chemistry [15 Hours]

Synthesis and Structural elucidation of Cholesterol and Oestrone, Reactions of Oestrone, Conversion of cholesterol into progesterone, testosterone and oestrone. Solid phase peptide synthesis (Merrifield synthesis), discussion on secondary and tertiary structure of proteins.

Structure and role DNA and RNA (genetic code). Biosynthesis of amino acids : phenylalanine, tyrosin, 3,4 – dopa, and proline.

Text Books

1. Jerry March, Advanced Organic Chemistry- Reactions, Mechanisms and Structure, Fourth Edition, John Wiley & Sons, 1992.

2. Francis A. Carey, Organic Chemistry, Third Edition, The McGraw-Hill Companies, Inc, 1996.
3. P. S. Kalsi, Organic Reactions and Mechanisms, Second Edition, New Age International Publishers, 2000.
4. I.L. Finar, Organic Chemistry, Volume. II, Fifth Edition, First Indian reprint, Pearson Education Asia Pte. Ltd., 2000.
5. Advanced Organic Chemistry – By Carey.F.A and Sunberg.R.G. Part A & B. Plenum Publishers; 2000.
6. Modern methods of organic synthesis – William Caruthers and Ion coldain, fourth edition, Cambridge press, 2014
7. Bio-organic Chemistry – by Anupama Parmar, Harish Kumar Chopra, and Parmjit Singh Panesar First edition, 2014, Alpha sciences
8. Name Reactions and Reagents in Organic Synthesis, 2nd Edition, Bradford P. Mundy, Michael G. Ellerd, Frank G. Favaloro, Jr. Wiley, 2005

Reference Books

1 S.H.Pine, J.B. Hendrickson, D.J.Cram and G.S.Hammond, Organic Chemistry, IV Edn. McGraw-Hill Company 1980.
2 S.M. Mukherji and S.P.Singh, Reaction Mechanism in Organic Chemistry, III Edn. 1984, MacMillan.
3 R.T.Morrison and R.N.Boyd, Organic Chemistry, Prentice-Hall, 6th Edn.,1992.
4 R.O.C. Norman, Principles of Organic Synthesis, Second Edition, Chapman and Hall, 1978.
5 Carey, Francis A., Sundberg, Richard J. Advanced Organic Chemistry, Part A: Structure and Mechanisms, Springer, 2007.
6 Carey, Francis A., Sundberg, Richard J. Advanced Organic Chemistry, Part B: Reaction and Synthesis, Springer, 2007.

Task:

1. Collect information's on the commercial manufacturers of reagents and their trade names for reagents.

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GOVERNMENT ARTS COLLEGE (AUTONOMOUS) , SALEM – 7

M. Sc CHEMISTRY

SECOND YEAR

THIRD SEMESTER

COURSE CODE –IX : PHYSICAL CHEMISTRY - III

COURSE CODE : 17PCH07 [75 Hours]

Learning Objectives:

- **To study the statistical point of thermodynamics**
- **To study basic electrochemistry**
- **To study physical spectroscopy**
- **To study oxidation and reduction chemistry**

Learning outcome :

- **Various concepts of statistical view of thermodynamics have been studied**
- **Gained knowledge on electrolytic potential and its theoretical background**
- **Gained on physical aspects of various spectral techniques**

UNIT –I Statistical Thermodynamics [15 Hours]

Objectives of Statistical Thermodynamics – concept of thermodynamical and mathematical probabilities – Distribution of distinguishable and indistinguishable particles. Maxwell – Boltzmann, Bose – Einstein and Fermi – Dirac statistics – derivation, comparison and applications.

Partition Functions – evaluation of Translational, Vibrational, Rotational and Electronic partition Functions – Thermodynamic Functions in terms of partition Function – Application of Partition Function to monatomic and diatomic gases. Heat capacities of Monatomic crystals – Einstein and Debye theory of heat capacities.

UNIT-II Electrochemistry –I [15 Hours]

Ions in solutions – Debye – Huckel theory of strong electrolytes – Debye-Hückel- onsager equation – verification and limitation – Debye – Hückel limiting law and its extension.

Electrode – Electrolyte interface adsorption at electrified interface – electrical double layers - Helmholtz Perrin, Guoy Chappman and Stern models– Electro capillary phenomena – Lippmann capillary equation –-electro kinetic Phenomena - Tiscelius method of separation of proteins – membrane potential.

UNIT –III Electrochemistry –II [15 Hours]

Mechanism of electrode reactions – polarization and over voltage – diffusion current – exchange and equilibrium current density - Butler-Volmer equation for one step electron transfer reaction – significance of equilibrium exchange current density and symmetry factor – transfer coefficient and its significance – Sackur tetrode equation.

Mechanism of Hydrogen and Oxygen evolution reactions. Corrosion and Passivation of metals – construction of Pourbaix and Evans diagrams – Prevention of Corrosion. Electrochemical energy systems – Primary and Secondary batteries – (dry cells, lead acid – storage batteries, silver - zinc cell, nickel - cadmium battery-Mercury Cell) – Fuel cells (H_2-O_2 fuel cell only). Principle, Instrumentation and applications of cyclic voltammetry.

UNIT- IV Quantum Chemistry –III [15 Hours]

Theory of chemical bonding- Comparison of MO and VB theories, Concept of Hybridisation – sp, sp^2 and sp^3 hybridisation , Huckel Molecular orbital (HMO) theory for conjugated π - system , application to simple systems such as Ethylene, butadiene and benzene, Physical Significance of HMO coefficients, Self consistant field approximation – Hartree's and Hartree- Fock Self Consistent field theory.

Approximation methods – Perturbation and Variation methods – application to Hydrogen and Helium atom – Spin- orbit interaction- LS coupling and JJ coupling- Term symbols and spectroscopic states.

UNIT- V Spectroscopy-II [15 Hours]

Atomic absorption spectroscopy – Principle; instrumentation, interferences and their corrections; applications of AAS.

Photoelectron Spectroscopy - Principle, PES of diatomic molecules and polyatomic molecules (HCl, HBr, HI, CO, NH_3, H_2O and N_3^- ion); PES, X-ray photoelectron spectroscopy (XPES) - Principle, Instrumentation and applications.

Principle and Instrumentation of SEM and TEM.

Mossbauer Spectroscopy - Doppler effect; isomer effect; Quadrupole interactions and magnetic interactions; simple applications to Iron and Tin compounds.

Text Books

1. Gurudeep raj, Advanced Physical chemistry, Goel Publishing House, Meerut.
2. M.C.Gupta, Statistical thermodynamics, Wiley Eastern, New Delhi, 1990
3. S. Glasstone, Introduction to Electrochemistry, Affiliated East West press, New Delhi,1960
4. D.R. Craw, Principles and Applications of Electrochemistry, Chapman and Hall, 1991
5. J. Robbins, Ions in Solution – An Introduction to Electrochemistry, Clarendon press, Oxford, 1972
6. R.K.Prasad, Quantum Chemistry, Wiley Eastern, New Delhi, 1992.
7. M.W.Hanna, Quantum Mechanics in Chemistry, W.A.Benjamin Inc, London 1965.
8. D.A.McQuarrie, Quantum Chemistry, University Science Books, Mill Valley, California, 1983
9. D.A. Skoog and D. M. West, Fundamentals of Analytical Chemistry, Holt Rinehart and Winston Publications, IV Edn, 1982
10. D.A. Skoog, Principles of Instrumental Analysis, Saunders College Pub.Co, III Edn., 1985

Reference Books

1. M.Dole, Statistical Thermodynamics, Prentice Hall, New York, 1954.
2. B.J.McCleland, Statistical Thermodynamics, Chapman and Hall, London 1973.

3. N.O.Smith, Elementary Statistical Thermodynamics, a Problems approach, Pleunum Press, New York 1980
4. J.O.M.Bockris and A.K.N. Reddy, Electrochemistry, Vols 1 and 2, Plenum, New York 1977.
5. C.M.A.Brett and A.M.O.Brett, Electrochemistry, Principles, Methods and application, OUP, Oxford (1993)
6. R.H.Rieger, Electrochemistry, Chapmann and Hall, New York (1994)
7. P.Delahay, Electrode kinetics and structure of Double layer, Interscience, 1965
8. A.K.Chandra, Introductory Quantum Chemistry, Tata McGraw Hill.
9. P.W.Atkins, Molecular Quantum Mechanics, Oxford university press, (1983)
10. J,N,Murrell, S.F.A.Kettle and J.M.Tedder, The Chemical Bond, Wiley.
11. Willard, Merit, Dean and Settle, Instrumental Methods of Analysis, CBS Publishers and Distributers, IV Edn., 1989

Task :

1. Dissect the used battery in your home and find out various parts carefully.
2. Collect samples that are affected by various types of corrosion available nearby in your house.

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) , SALEM – 7

M. Sc CHEMISTRY

SECOND YEAR

THIRD SEMESTER

ELECTIVE COURSE -II : SPECTROSCOPY AND GREEN CHEMISTRY

COURSE CODE : 17PCHM2 [75 Hours]

Learning Objectives:

- **To study basic concepts and applications of various organic spectroscopy**
- **To develop the knowledge of interpreting spectra**

Learning outcome :

- **Concepts of spectroscopy have been studied**
- **Gained knowledge on interpreting a spectra of an organic compound**

UNIT I UV-VIS, IR spectroscopy [15 Hours]

UV-VIS : the nature of the electronic excitations, origin of UV band structure and the principle of absorption, chromophore and auxochrome, effect of conjugation, substituents with unshared electrons and their capability of π - conjugation . Colour in compounds. Woodward – Fieser rules for dienes, enones and aromatics. Calculations of λmax for organic molecule.

IR: IR absorption process, modes of stretching and bending vibrations, bond properties and its relations to absorption frequencies, Characteristic group frequencies of aliphatic and aromatic organic molecule, carbonyl, carboxylic acid, ester, alcohol, phenol and amides Factors influencing vibrational frequencies, interpretation of IR spectra of organic molecules.

UNIT II NMR (^{1}H and ^{13}C) [15 Hours]

NMR spectroscopy : Mechanism of absorbance, Chemical shift and shielding, factors influencing chemical shift, spin-spin coupling, magnetic anisotropy, hydrogen attached to elements other than carbon, Pascals triangle, calculation of coupling constants, mechanism of coupling(one bond, geminal, vicinal and long range coupling),

Variation of coupling constant with dihedral angle. Shift Reagents. Identification of proton in various chemical environments to assign structure to the organic molecules using chemical shift values.

^{13}C NMR spectroscopy : Chemical shift, spin-spin splitting, Nuclear Overhauser effect , tetrahedral carbons, heterocyclic structures, trigonal carbons. Triply bonded carbons, carbonyl carbons, applications of ^{13}C NMR to find the different carbon functional groups. Terminology of NOISY, DEPT, INEPT

UNIT III Mass spectroscopy and ORD-CD [15 Hours]

Mass spectra – Instrumentation – resolution, EI and CI methods – Base peak, isotopic peaks, meta stable peak, parent peak, determination and use of molecular formula, recognition of molecular ion peak – FAB. Fragmentation – general rules – pattern of fragmentation for various classes of compounds, McLafferty rearrangement, Importance of meta stable peaks.

ORD-CD : Introduction to theory and terminology – cotton effect – ORD curves – axial halo ketone rule and its applications – octant rule – its applications – applications of ORD to determine absolute configuration of monocyclic ketones –comparison between ORD and CD-their inter relationships.

UNIT IV ESR spectroscopy and applications of spectroscopy **[15 Hours]**

ESR Spectroscopy : Basic principles, zero field splitting and Kramer's degeneracy hyperfine splitting , factors affecting the 'g' value. Isotropic and anisotropic hyperfine coupling constants. Applications of ESR spectroscopy.

Applications of spectroscopy : Structural elucidation of simple organic molecules using UV-Vis, IR, NMR, MASS, ORD-CD spectral techniques. Identification of stereo specificity using NMR spectral technique. Problems.

UNIT V Green Chemistry and non-conventional techniques in chemistry[15 Hours]

Green Chemistry –Set of Principles of Green Chemistry, atom economy Green synthetic methods, Catalytic methods, Organic synthesis in aqueous media, Ionic liquid, Supercritical fluids and microwave, Solvent free organic reactions, elemental idea of solid phase organic synthesis .

Microwave assisted organic synthesis – microwave activation, microwave heating, advantages of microwave exposure and specific effects of microwaves. Organic synthesis under microwaves – benefits, limitations, equipments.

Ultrasound assisted reactions –origin of chemical effect of ultra sound, acoustic cavitation, cavitation in homogeneous surfaces.

Text Books

1. Kenneth . Klabunde, Nanoscale Materials in Chemistry, John Wiley & Sons, Inc. 2002
2. Rashmi Sanghi, M. M. Srivastava, Green Chemistry, Environment Friendly Alternatives, Narosa Publishing House, 2007
3. V. Kumar, An Introduction to Green Chemistry, Vishal Publishing CO. Jalandhar, 2007
4. R.M Silverstein, C.G. Bassler and Monsil, Spectrometric identification of organic compounds, 6th Edn., John Wiley & sons, New York 2004.
5. William Kemp, Organic Spectroscopy, ELBS, 3rd Edition, New Delhi, 2011.
6. Principles and Applications of ESR Spectroscopy, Lund, Anders, Shiotani, Masaru, Shimada, Shigetaka, 2011, Springer.
7. Donald Pavia, Lampman, Krytz, Introduction to spectroscopy, Brooks cole learning, fourth edition, 2009.

Task:

1. make a chart of various energy resources in non conventional heating

Collect spectroscopic problems appeared in competitive examinations conducted by NGO's and govt. organizations.

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) , SALEM – 7

M. Sc CHEMISTRY

SECOND YEAR

THIRD SEMESTER

ELECTIVE COURSE -II MEDICINAL CHEMISTRY

COURSE CODE 13PCHM2

[75 Hours]

Objectives

1. To understand the basic concepts of medicinal chemistry
2. To understand the structure activity relationships of selected drug molecules

Unit I Basic Concepts (15 Hours)

Drug design - analogues and pro-drugs, factors governing drug design, rational approach,method of variation and tailoring of drugs; Physical properties-factors governing drug action at active site, factors governing ability of drugs to reach active site, dissociation constants, isosterism and bioisosterism; general anaesthetics-inhalation anaesthetics, intravenous anaesthetics and basal anaesthetics;mode of action; local anaesthetics-classification and syntheses, sedatives and hypnotics-classification, synthesis, mode of action and structure-activity relationship.

Unit II Anticonvulsants, Stimulants and Antipyretic Analgesics (15 Hours)

Anticonvulsants - classification, synthesis and mode of action; Muscle relaxants-classification, synthesis and mode of action. Central nervous system stimulants-classification, synthesis and mode of action; Antipyretic analgesics- classification, synthesis and mode of action;

Unit III Other Analgesics (15 Hours)

Narcotic or Opiate analgesics - classification, preparation and mode of action; Narcotic antagonists; Cardiovascular drugs-classification, synthesis and mode of action; Autonomic drugs-synthesis and mode of action of sympathomimetic drugs, antiadrenergic drugs, cholinomimetic drugs, antimuscarinic drugs, ganglionic blocking agents and adrenergic

neurone blocking agents; Diuretics - synthesis and mode of action of mercurial and non-mercurial diuretics.

Unit IV Antihistamines, Anti-inflammatory and Antiparkinson drugs (15 Hours)

Antihistaminics - synthesis and mode of action of histamine H1 receptor antagonists and histamine H2-receptor blockers; prevention of histamine release; structure-activity relationships amongst H1-receptor blockers. Non-steroidal anti-inflammatory drugs(NSAID)-synthesis and mode of action of heteroarylacetic acid analogues, arylacetic acid analogues, arylpropionic acid analogues, naphthalene acetic acid analogues, gold compounds, salicylic acid analogues and pyrazolones and pyrazolodiones; Antiparkinsonism agents-synthesis and mode of action of piperidine analogues, pyrolidine analogues and phenothiazine analogues.

Unit V Other drugs (15 Hours)

Expectorants and antitussives-synthesis and mode of action of sedative expectorants, stimulant expectorants and centrally acting antitussive agents. Sulphonamides-preparation and mode of action of sulphonamides for general, urinary, intestinal and local infection; sulphonamide inhibition. Antimalarials-synthesis and mode of action of aminoquinoline analogues, aminoacridine analogues, guanidine analogues, pyrimidine analogues, sulfone and quinine analogues; Steroids-synthesis and mode of action of sterols, sex harmones, cardiac glycosides, bile acids and sapogenins. Antibiotics-synthesis and mode of action of penicillins, aminoglycoside antibiotics, chloramphenicol and tetracyclines.

Text Books

1. Ashutosh Kar, Medicinal Chemistry, New Age International, 1996.
2. W.O.Foye, Principles of medicinal chemistry, 2nd edn., Lea & Febiger, Philadelphia, 1981.

Reference Books

1. M.E.Wolff, Burger’s medicinal chemistry, 4th Edn., John Wiley &Sons, New York, 1981.
2. F.F.Blicke and R.H.Cox, Medicinal Chemistry, John Wiley &Sons, New York, 1959.

3. D.Lednicer and L.A.Mitscher, Organic Chemistry of drug synthesis, John Wiley & Sons, New York, 1959.

4.J.E.Hoover, Remington's Pharmaceutical sciences, 15th Edn. Mack Publ.Company, Easton, 1975.

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) , SALEM – 7

SECOND YEAR
M. Sc CHEMISTRY

FOURTH SEMESTER

COURSE CODE-VIII : INORGANIC CHEMISTRY-III

COURSE CODE : 17PCH08 [75 Hours]

Learning Objectives:

- **To study electronic spectra complexes**
- **To study the reaction mechanism of inorganic complexes**
- **To study various concepts of organometallic bond**
- **To gain knowledge on bio-inorganic chemistry**

Learning outcome :

- **Gained knowledge on electronic spectra interpretation**
- **Studied the reaction mechanism of complexes**
- **Gained on knowledge on organo metallic chemistry**
- **Gained knowledge bio-inorganic complexes**

UNIT-I Electronic Spectra of Complexes [15 Hours]

Spectroscopic Term symbols for d^n ions – derivation of term symbols and ground state term symbol, Hund's rule; Selection rules – break down of selection rules, spin-orbit coupling, band intensities, weak and strong field limit – correlations diagram; energy level diagrams; Orgel and Tanabe-Sugano diagrams; John-teller distortion; effect of distorsion and spin orbit coupling on spectra; evaluation of Dq and B values for octahedral complexes of Nickel; Charge transfer spectra; Magnetic properties of complexes.

UNIT-II Reaction mechanism in complexes [15 Hours]

Electron transfer reactions – Outer and inner sphere processes; atom transfer reaction, formation and rearrangement of precursor complexes, the bridging ligand,

successor complexes; cross reactions and Marcus – Hush theory. Application of electron transfer reaction in synthesis.

Reaction mechanism of coordination compounds – substitution reactions, labile and inert complexes;

Substitution in square plannar complexes – General mechanism; reactivity of Platinum complexes; influences of entering and leaving groups; the trans effect – theories, trans influence

Substitution in octahedral complexes – general mechanism, discussion of A ,D, I_A, I_D, and DC_B mechanism; replacement of coordinated water; mechanism of acid hydrolysis and base hydrolysis – Conjugate base mechanism;

UNIT-III Organometallic Chemistry [15 Hours]

Carbon donors – Alkyls and Aryls preparation and properties; Carbonyls- 18 electron rule, isolobal concept – application to structure of carbonyls (Simple and Poly nuclear); Nitrosyls – bridging and terminal nitrosyls, bent and linear nitrosyls; dinitrogen complexes; chain carbon donors – olefins acetylene and allyl complexes – synthesis, structure and bonding; cyclic Carbon donors – Metallocene –synthesis, structure and bonding(Ferrocene only).

Reactions – association reaction – only ligand protonation; substitution – electrophilic and nucleophilic attack on ligands; addition and elimination; carbonylation and decarbonylation; oxidative addition to organometallics; flexural isomerism. Insertion reactions (carbonyl, alkene insertion).

UNIT-IV Catalysis [15 Hours]

Hydrogenation of olefins (Wilkinsons Catalyst); Hydroformylation of olefins using Cobalt or Rhodium catalysts (oxo process); Oxidation of olefins to aldehydes and ketones (Wackers process); Polymerization (Ziegler Nutta catalyst); Cyclo oligomerization of acetylene using Nickel catalyst (Reppe's catalyst); Coupling reactions (Miyaura-Suzuki, Mizoroki-Heck, Stille, Sonagashira and Heckcoupling reactions only) Polymer bound catalysts.

UNIT-V Bioinorganic Chemistry [15 Hours]

Role of metals in biological system - their occurrence and function, Na^+/K^+ pump, O_2 binding properties of heme (haemoglobin and myoglobin) and non-heme proteins

(hemocynin & hemerythrin). Electron transfer proteins: Iron –sulphur proteins (ferredoxin, rubridoxin) and cytochromes, Vitamin B12 mechanism of action.

Text books

1. J.E.Huheey, E.A.Keiter and R.L keiter, inorganic Chemistry –Prnciples of structure and reactivity, 4th edition, Pearson-Education, 2002.
2. F.A.Cotton and G.Wilkinson, Advanced Inorganic Chemistry, Wiley Eastern, 5th edition, 1988.
3. S.F.A.Kettle, Coordination compounds, ELBS, 1973.
4. M.C.Day and J.Selbin, Theoretical ihorganic Chemistry, Van Nostrand Co., NY, 1974.
5. K.F.Purcell and J.C.Kotz, Inorganic Chemistry, WB. Sanders Co., USA 1977.
6. D.F.Shriver, P.W.Atkins and C.H.Longford, Inorganic Chemistry, ELBS, 2nd edition, 1994.
7. R.B.Heslop and K.Jones, Inorganic Chemistry, Elsevier, 1976.
8. S.J.Lippard and Berg, Principles of Bioinorganic Chemistry, Univ. Science Books, 1994.
9. D.E.Fenton, Biocoordination Chemistry, Oxford Science Publication 1995.

Reference Books

1. D.Bannerjea, Coordination Chemistry, Tata-McGrow hill, 1993.
2. M.L.Tobe, Inorganic Reaction Mechanism, Nelson, 1972.
3. K.Burger, Coordination Chemistry Experimental Methods, Butterworths. 1973.
4. B.N.Figgis, Introduction to Ligand Fields, Wiley Eastern Ltd., New Delhi, 1976.
5. J.A.Cowan, Inorganic biochemistry, Wiley-VCH, New York, 1997.
6. W.E.Addition, structural principles of Inorganic Chemistry, Longman, 1961.

Task:

1. Collect information's from web pertaining to the various industrial catalysis used in petrochemical industries.

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) , SALEM – 7

M. Sc CHEMISTRY

FOURTH SEMESTER

CORE PRACTICAL COURSE : ORGANIC CHEMISTRY PRACTICAL-III

COURSE CODE : 17PCHP4 [90 HOURS]

I. Organic Estimation

1. Phenol
2. Aniline
3. Methyl Ketone
4. Glucose
5. Iodine value of an oil
6. Saponification value of an oil.

II Organic Preparation, Involving Two Stages

1. Sym-tribromobenzene from aniline.
2. m-Nitrobenzoic acid from methyl benzoate
3. para -Nitroaniline from acetanilide.
4. Benzanilide from benzophenone.
5. para –Amino benzene sulphanamide from acetanilide
6. Anthraquinone from phthalic anhydride.

III. Extraction of Natural Products:

1. Caffeine from tea leaves.
2. Citric acid from lemon.

IV Chromatographic Separations

1. Column chromatography : separation of a mixture of ortho and

para-Nitroanilines.

2. Thin layer Chromatography : separation of a mixture of ortho and para – Nitroanilines.
3. Paper chromatography – identification of natural alpha amino acids.

Ref : 1. Vogel's Practical organic chemistry

2. Laboratory manual of organic chemistry – B.B.Dey and M.V.Sitaraman

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) , SALEM – 7

M. Sc CHEMISTRY

FOURTH SEMESTER

CORE PRACTICAL COURSE : INORGANIC CHEMISTRY PRACTICAL -IV

COURSE CODE : 17PCHP5 [90 HOURS]

Part I Quantitative analysis of complex materials

A) Quantitative analysis :

Quantitative analysis of mixture of iron and magnesium; iron and nickel, copper and nickel and copper and zinc.

Part II : Preparations of the following :

1. Sodium hexanitrocobaltate (III)
2. Tris (ethyleneamine) Cobalt (III) chloride
3. Chloropentammine Cobalt (III) chloride
4. Bis (acetylacetanato) Copper (II)
5. Hexamminecobalt (III) chloride
6. Hexamminenickel (II) chloride.

GOVERNMENT ARTS COLLEGE (AUTONOMOUS) , SALEM – 7

M. Sc CHEMISTRY

FOURTH SEMESTER

CORE PRACTICAL COURSE : PHYSICAL CHEMISTRY PRACTICAL-V

COURSE CODE : 17PCHP6 [90 HOURS]

Physical chemistry experiments

Potentiometric Titrations

Acid base Titrations

3. Strong acid Vs strong base
4. Weak acid Vs Strong base
5. Mixture of acid Vs strong base

Precipitation Titrations

6. Silver nitrate Vs Potassium chloride
7. Silver nitrate Vs potassium iodide
8. Mixture of halides Vs Silver Nitrate
9. Determination of solubility of silver nitrates

Redox titrations

10. Estimation of Ferrous ammonium sulphate
11. Estimation of Ceric ammonium sulphate
12. Determination of pH of a buffer solution and dissociation constant weak acid.
13. Determination of equilibrium constant of the reaction

$$[Ag(NH_3)_2]^+ \leftrightarrow Ag^+ + 2NH_3$$

Polarimetry

14. Inversion of Cane sugar
15. Comparison of the relative strength of acids

Chemical kinetics

16. Study of primary salt effect and kinetic of the reaction between KI and Potassium persulphate
17. Study of the reaction between KI and Potassium persulphate at different temperatures