

ANNAMALAI UNIVERSITY



DEPARTMENT OF CHEMISTRY

M. Sc. CHEMISTRY (5 YEAR INTEGRATED COURSE)

REGULATIONS AND SYLLABUS

(2014 - 2015 Onwards)

DEPARTMENT OF CHEMISTRY
M.Sc. CHEMISTRY
(Five Year Integrated Programme)
Regulations and Syllabus
Regulations

Eligibility : Candidates for admission to the First year of the Five Year Integrated M.Sc. Chemistry Degree Programme shall be required to have passed in higher Secondary Course examinations (HSC) (10+2 level) or equivalent thereto with a minimum of 50% marks in any one of the following three combinations.

1. Maths, Physics and Chemistry
2. Biology, Physics and Chemistry
3. Botany, Physics and Chemistry
4. Zoology, Physics and Chemistry

Master Programme: A Master's Programme consists of a set of Core courses and common course on languages, Computer, Civics, etc.

Core courses are basic courses required for each programme. The number and distribution of credits for core courses will be decided by the respective faculties.

Common courses, suggested by the respective departments, may be distributed in the first four semesters.

A course is divided into five units to enable the students to achieve modular and progressive learning.

Semesters: An academic year is divided into two semesters, Odd semester and Even semester. The normal semester periods are:

Odd semester: July to November (90 working days)

Even semester: December to April (90 working days)

Credit : The term credit is used to describe the quantum of syllabus for various programmes in terms of hours of study. It indicates differential weightage given according to the contents and duration of the courses in the curriculum design.

The minimum credit requirement for a Five year Integrated Master's Programme shall be 225.

The core courses shall carry 152 credits, Common courses shall carry 53 credits and the other courses shall carry 20 credits.

Courses : A course carrying one credit for lectures, will have instruction of one period per week during the semester, if four hours of lecture is necessary in each week for that course then 4 credits will be the weightage. Thus normally, in each of the courses, credits will be assigned on the basis of the lecture tutorials/laboratory work and other form of learning in a 15 week schedule:

- i) One credit for each lecture period per week.
- ii) One credit for every three periods of laboratory or practical work per week

Grading System: The term Grading System indicates a 10 point scale of evaluation of the performance of students in terms of marks, grade points, letter grade and class.

Duration: The duration for completion of a Five year Integrated Master's Programme in any subject is Ten semesters.

Structure and Programme : The Five year Integrated Master's Programme will consist of:

- i) Core courses and Common course which are compulsory for all students.
- ii) Optional courses which students can choose from amongst the courses offered by the other Departments of Science faculty as well as by the Departments of other faculties. (Arts, Education and Indian Language)

Attendance: Every teaching faculty handling a course shall be responsible for the maintenance of attendance register for candidates who have registered for the course.

Each student should earn 80% attendance in the courses of the particular semester failing which he or she will not be permitted to sit for the end-semester examination.

However, it shall be open to the authorities to grant exemption to a candidate who has failed to obtain the prescribed 80% attendance for valid reasons on payment of a condonation fee and such exemptions should not under any circumstance be granted for attendance below 70%.

Examinations : The internal assessment for each theory course carries 25% marks and practical course 40% of marks which is based on two internal tests and a variety of assessment tools such as seminar and assignment. The pattern of question paper will be decided by the respective faculty. The tests are compulsory.

For internal assessment evaluation, the break-up marks shall be as follows:

Theory	Internal Marks	Practical	Internal Marks
Test-I	10	Test-I	15
Test-II	10	Test-II	15
Attendance and Record	5	Attendance and Record	10
Total	25	Total	40

There will be one End Semester Examination (75% marks) of 3 hours duration for each theory course. The pattern of question paper will be decided by the respective faculty.

Evaluation : The performance of a student in each course is valued in terms of Percentage of Marks (PM) with a provision for conversion to Grade Point (GP). The sum total performance in each semester will be rated by GPA while the continuous performance in Core, Allied and optional courses will be marked by (CGPA).

Marks and Grading : The student cannot repeat the assessment of sessional test I and sessional test II. However, if for any compulsive reason, the student could not attend the test, the prerogative of arranging a special test lies with the teacher in consultation with the Head of the Department.

A student has to secure 50% minimum in the End Semester Examination. The student who has not secured minimum of 50% of marks (sessional plus end semester examination) in a paper shall be deemed to have failed in that paper.

A candidate who has secured a minimum of 50% marks in all the papers prescribed in the programme and earned 225 credits will be considered to have passed the integrated Master's Programme.

Grading : A ten point rating scale is used for the evaluation of the performance of the student to provide letter grade for each course and overall grade for the Master's Programme.

Marks	Grade Point	Letter Grade	Class
90 +	10.0	S	Exemplary
85 - 89	9.0	D ⁺⁺	Distinction
80 - 84	8.5	D ⁺	„
75 - 79	8.0	D	„
70 - 74	7.5	A ⁺⁺	First Class
65 - 69	7.0	A ⁺	„
60 - 64	6.5	A	„
55 - 59	6.0	B	Second Class
50 - 54	5.5	C	„
49 or Less		F	Fail

Grade cards will be issued to the students, after the declaration of results. The grade card will contain the list of programmes registered during the semester, the grades scored and the Grade point Average for the semester.

GPA is the sum of the products of the number of credits of a programme with the grade point scored in that programme, taken over all the courses for the semester divided by the sum of the number of credits for all courses taken in that semester. SS CGPA is similarly calculated considering the core, allied and optional courses taken from I semester to X semester.

The results of the final semester will be withheld until the student obtains passing grade in all the programmes of all earlier semester.

Degree will be Awarded as Follows:

(i) For UG Degree : B.Sc., degree will be awarded after the completion of VI Semester to the candidate who desires and have passed all the Courses upto VI Semester with the following Classification based on CGPA.

For **First class with Distinction** the student must earn 135 Credits, Pass all the courses in the first attempt and obtain a CGPA of 8.25 or above in Part - III Core and Allied courses from I to VI Semesters.

For the **first class** the student must earn 135 Credits, Pass all the courses and obtain a CGPA of 6.5 or above in Part-III Core and Allied courses from I to VI Semesters.

For the **Second class** the student must earn 135 Credits and Pass all the courses and obtain a CGPA of 6.0 or above in Part - III Core and Allied courses from I to VI Semesters.

Those who complete successfully all the X – Semester Examinations will be issued both B.Sc., and M.Sc., degree Certificates.

(ii) For PG Degree : M.Sc. degree will be awarded after successful completion of X Semesters examinations and Earning 225 Credits with the following Classification based on CGPA.

For **First class with Distinction** the student must earn 225 Credits, Pass all the courses in the first attempt and obtain a CGPA of 8.0 or above in Part-III Core, Allied and Optional courses from I to X Semesters.

For the **first class** the student must earn 225 Credits, Pass all the courses and obtain a CGPA of 6.5 or above in Part-III Core, Allied and Optional courses from I to X Semesters.

For the **Second class** the student must earn 225 Credits and Pass all the courses and obtain a CGPA of 6.0 or above in Part-III Core, Allied and Optional courses from I to X Semesters.

Ranking of Candidates

(i) For UG Degree

The Candidates who are eligible to get the B.Sc degree in First class with distinction will be ranked on the basis of CGPA scored in Part-III Core and Allied courses of study from I Semester to VI Semesters.

The Candidates Passing with First Class will be ranked next to those with distinction on the basis of CGPA scored in Part-III Core and Allied courses of study from I Semester to VI Semesters.

(ii) For PG Degree

The Candidates who are eligible to get the M.Sc degree in First class with distinction will be ranked on the basis of CGPA scored in Part-III Core, Allied and Optional Courses of Study from I Semester to X Semesters.

The Candidates Passing with First Class will be ranked next to those with distinction on the basis of CGPA scored in Part-III Core, Allied and Optional courses of study from I Semester to X Semesters.

Candidates who obtain **First Class with Distinction** shall be deemed to have passed the examinations provided he/she passes all the papers prescribed for the programme at the **First Appearance**.

R13. Transitory Regulations : Wherever there had been change of syllabi, examinations based on the existing syllabi will be conducted for three times consecutively after implementation of the new syllabi in order to enable the students to clear the arrears. Beyond that the students will have to take up their examinations in equivalent programmes, as per the new syllabi, on the recommendations of the Head of the Department concerned.

The University shall have powers to revise or change or amend the regulations, the scheme of examinations, the programmes of study and the syllabi from time to time.

M. Sc CHEMISTRY (Five Year Integrated)
(2014 – 2015 Onwards)

Total Credits upto five years : 225

Course Code	Course Title	Hours*	Credit	Inter. Mark	Exter. Mark	Total
First Semester						
ITAC 11	Tamil Paper – I: பயன்பாட்டுத்தமிழும் செம்மொழி வரலாறும்	3	3	25	75	100
IENC 12	English Through Literature – I: Prose	3	3	25	75	100
ICEC 13	Civics, Environmental and Health Sciences	3	3	25	75	100
ICHT 14	Inorganic, Organic And Physical Chemistry - I	5	5	25	75	100
ICHA 15	Ancillary - I: Mathematics - I / Botany - I	4	4	25	75	100
Second Semester						
ITAC 21	Tamil Paper – II: (செய்யுளும் உரைநடையும்)	3	3	25	75	100
IENC 22	English Thorough Literature – II: Poetry	3	3	25	75	100
ICEC 23	Computer Applications - I	3	3	25	75	100
ICHT 24	Inorganic, Organic and Physical Chemistry - II	5	5	25	75	100
ICHP 25	Practical – I: Volumetric Analysis	6	2	40	60	100
ICHA 26	Ancillary I: Mathematics - II / Botany - II	4	4	25	75	100
ICHP 27	Ancillary: Botany Practical - I	5	2	40	60	100
Third Semester						
ITAC 31	Tamil Paper – III (உரைநடையும் நாடகமும்)	3	3	25	75	100
IENC 32	English through literature – III: Drama	3	3	25	75	100
ICHT 33	Inorganic, Organic And Physical Chemistry - III	6	6	25	75	100
ICHP 34	Practical – II: Inorganic Qualitative Analysis	6	3	40	60	100
ICHA 35	Ancillary - II : Physics - I	4	4	25	75	100
Fourth Semester						
ITAC 41	Tamil Paper – IV (தமிழ் இலக்கிய வரலாறு)	3	3	25	75	100
IENC 42	English through Literature – IV : Short Story	3	3	25	75	100
ICHT 43	Inorganic, Organic And Physical Chemistry – IV	6	6	25	75	100
ICHP 44	Practical – III: Preparation And Analysis of Organic Compounds	6	3	40	60	100
ICHA 45	Ancillary - II: Physics - II	4	4	25	75	100
ICHP 46	Ancillary : Physics Practical	6	3	40	60	100
Fifth Semester						
ICHT 51	Organic Chemistry - I	6	6	25	75	100
ICHT 52	Inorganic Chemistry - I	6	6	25	75	100
ICHT 53	Physical Chemistry - I	6	6	25	75	100
ICHT 54	Analytical Chemistry	6	6	25	75	100
ICHP 55	Practical – IV: Gravimetric Analysis	6	3	40	60	100
Sixth Semester						
ICHT 61	Organic Chemistry - II	6	6	25	75	100
ICHT 62	Inorganic Chemistry - II	6	6	25	75	100
ICHT 63	Physical Chemistry - II	6	6	25	75	100
ICHT 64	Pharmaceutical Chemistry	6	6	25	75	100
ICHP 65	Practical – V: Physical Chemistry Practicals	6	3	40	60	100

Seventh Semester						
ICHT 71	Organic Chemistry – III	4	4	25	75	100
ICHT 72	Inorganic Chemistry – III	4	4	25	75	100
ICHT 73	Physical Chemistry – III	4	4	25	75	100
Eighth Semester						
ICHT 81	Organic Chemistry – IV	4	4	25	75	100
ICHT 82	Inorganic Chemistry – IV	4	4	25	75	100
ICHT 83	Physical Chemistry – IV	4	4	25	75	100
ICHP 84	Practical VI: Organic Chemistry Practicals – I	4	4	40	60	100
ICHP 85	Practical VII: Inorganic Chemistry Practicals – I	4	4	40	60	100
ICHP 86	Practical VIII : Physical Chemistry Practicals – I	4	4	40	60	100
ICHT 87	Statistical Methods	4	4	25	75	100
Ninth Semester						
ICHT 91	Synthetic Organic Chemistry	4	4	25	75	100
ICHT 92	Analytical Techniques	5	5	25	75	100
ICHT 93	Spectroscopy And Spectrometry	5	5	25	75	100
ICHT 94	Basic Bio-Chemistry	4	4	25	75	100
ICHT 95	Soft Skill Development	4	4	25	75	100
Tenth Semester						
ICHT 101	Advanced Organic Chemistry	4	4	25	75	100
ICHT 102	Advanced Physical Chemistry	4	4	25	75	100
ICHT 103A (or) ICHT 103B	Chemistry of Advanced Materials (or) Advanced Inorganic Chemistry	4	4	25	75	100
ICHT 104A (or) ICHT 104B	Applied Chemistry (or) Industrial Medicinal Chemistry	4	4	25	5	100
ICHP 105	Practical IX : Organic Chemistry Practical – II	4	4	40	60	100
ICHP 106	Practical X : Inorganic Chemistry Practical – II	4	4	40	60	100
ICHP 107	Practical XI : Physical Chemistry Practical – II	4	4	40	60	100

FIRST SEMESTER

Part – I : Language - Tamil - தமிழ் தாள் - 1

ITAC- 11 – பயன்பாட்டுத்தமிழும் செம்மொழி வரலாறும்

நோக்கம்: மொழியமைப்பினை விளக்குதல்: மொழிப் பயன்பாட்டில் உருவான – உருவாகும் மாற்றங்களைப் புலப்படுத்துதல் திசை மொழிகளின் கலப்பினால் தமிழ் மொழியில் ஏற்படும் மாற்றங்களை விளக்குதல் மொழிக் குடும்பங்கள் குறித்தும் செம்மொழித் தமிழின் சிறப்புகள் குறித்தும் செம்மொழி ஏற்புக் குறித்தும் விளக்குதல்.

அலகு - 1

எழுத்துக்களின் எண்ணிக்கையும் வகைகளும், எழுத்துகளின் மாத்திரை, கால இடைநிலைகள், மூவகைப் போலிகள், இருவகைப் பதங்கள், புணர்ச்சிகள்.

அலகு - 2

சொற்றொடர் வகைகள் (மூவகை மொழி) தொடரிலக்கணத்தில் காணப்பெறும் வழுவும், வழு அமைதியும் பத்தியமைப்பையும் நிறுத்தற் குறியீடுகள் பயன்பாடும். ஊரைநடை எழுதும் போது மேற்கொள்ள வேண்டிய விதிமுறைகள்.

அலகு - 3 மேடைத்தமிழ்

நீங்களும் பேச்சாளர் ஆகலாம் - குமரி அனந்தன் மேடைப்பேச்சுக்கு தயார் செய்தல்- பேச்சாளருக்குரிய தகுதிகள்- பேசும் முறைகள் - பழக்க வழக்கங்கள்.

அலகு - 4 படைப்புத்திறன்

சிறுகதை- கவிதை- கட்டுரை- ஓரங்க நாடகம்- நூல் குறித்த திறனாய்வு எழுதப் பயிற்சிதரல்.

அலகு - 5 பயன்பாட்டுத் தமிழும் செம்மொழி வரலாறும்

மொழி- விளக்கம்- மொழிக்குடும்பங்கள் உலகச் செம்மொழிகள்- இந்தியச் செம்மொழிகள்- செம்மொழித் தகுதிகள்- வரையரைகள்- வாழும் செம்மொழித் தமிழ்- தமிழின் தொன்மை- தமிழின் சிறப்புகள்- தமிழ்ச் செம்மொழி நூல்கள். தமிழ் செம்மொழி அறிந்தேற்பு பரிதிமாற்கலைஞர் முதல் தற்கால அறிஞர்கள் வரை (அறிஞர்கள்- அமைப்புகள்- நிறுவனங்கள்- இயக்கங்கள் தொடர் முயற்சிகள்- அறப்போராட்டங்கள்- உலகத் தமிழ்ச் செம்மொழி மாநாச். கோவை -2010)

பார்வை நூல்கள்

1. சோம. இளவரசு. நன்னூல் காண்டிகை உரை, மணிவாசகர் பதிப்பகம், சென்னை.
2. அ. கி. பரந்தாமனார். நல்ல தமிழ் எழுத வேண்டுமா? பாரி நிலையம், சென்னை.
3. பேச்சுக்கலை- கே. வீரராகவன். வலம்புரி பதிப்பகம். திருநின்றவூர்- 602 024.
4. குமரி அனந்தன், நீங்களும் பேச்சாளர் ஆகலாம், பூம்புகார் பிரசுரம், சென்னை.
5. எழுதுவது எப்படி? மகரம் (தொ. ஆ) பழனியப்பா பிரதர்ஸ், சென்னை.
6. ம. திருமலை- பேச்சுக்கலை- மீனாட்சி புத்தக நிலையம் - 2008, மதுரை.
7. சாலினி இளந்திரையன், தமிழ் செம்மொழி ஆவணம், மணிவாசகர் பதிப்பகம், சென்னை, 2005.
8. கால்டுவெல், “திராவிட மொழிகளின் ஒப்பிலக்கணம்”- கழக வெளியீடு, சென்னை.
9. ச. சாரதாம்பாள்- சங்கச் செவ்வியல், மீனாட்சி புத்தக நிலையம், மதுரை (1993)
10. வா.சே.குழந்தைசாமி -உலகச் செவ்வியல் மொழிகளின் வரிசையில் தமிழ், பாரதிபதிப்பகம், சென்னை.
11. ஜி. ஜான் சாமுவேல்- செம்மொழி வரிசையில் தமிழ், சென்னை 2004.
12. சாலினி இளந்திரையன்- தமிழ்ச்செம்மொழி ஆவணம், மணிவாசகர் பதிப்பகம், சென்னை, 2004.
13. சு. அகத்தியலிங்கம் - சங்க இலக்கியம்- செவ்வியல் பார்வை மெய்யப்பன் பதிப்பகம், சிதம்பரம்- 2004
14. மணவை. முஸ்தபா- செம்மொழி உள்ளும் புறமும், அறிவியல் தமிழ் அறக்கட்டளை, சென்னை.

IENC 12 - English Through Literature - I

Unit -I

Bonnie Chamberlain	“The Face of Judas Iscariot”
Swami Vivekananda	“Speech at World Parliament of Religion”

Unit -II

Stephen Leacock	“My Financial Career”
Bhimrao Ambedkar	“Speech on 4 th November 1948 in the Constituent Assembly”

Unit -III

Robert Lynd	“On Forgetting”
Nirad C. Chaudhuri	“Indian Crowds”

Unit -IV

A. G. Gardiner	“All about a Dog”
Ruskin Bond	“My Eccentric Guests”

Unit -V

Martin Luther King (Jr.)	“I Have a Dream”
Khushwant Singh	“The Portrait of a Lady”

Text Book: S.Ayyappa Raja, P.Shanmugasundari, T.Deivasigamani, N.Saravana Prabhakar, B. Karthikeyan, *English Through Literature: Prose.*

ICEC 13 - Civics, Environmental and Health Sciences

(A) Civics

Unit-I : Introduction

Democracy – Citizenship – duties of Good Citizen – Society, State and Citizen – Limits of State Activity.

Indian Constitution, Preamble – Basic Features – Citizenship – Fundamental Rights – Fundamental Duties.

Unit-II : Political System

Union Government: President – Prime Minister – Parliament – Supreme Court – Electoral System – State Government: Governor – Chief Minister – Center State Relations.

Local Government : Urban Administrative System – Panchayat Raj System.

Reference Books

- 1) B.L. Fadia, Indian Government and Politics. Agra, Sahitya Bhawan Publication, 1999.
- 2) S.R. Maheswari, Local Government in India. Agra, Lakshmi Narain Agarwal, 1996.
- 3) R.C. Agarwal, Indian Political System. New Delhi, S. Chand & Company, 2000
- 4) McCrocklin H. James, Building Citizenship. USA, Allyn and Bacon INC, 1961.

B) Environmental Sciences

Unit-I : Ecosystems :

Fundamental Concepts and Principles – Structure and Function – Classification – Modern concept of Ecosystem – Energy flow – Ecological indicators.

Unit-II : Environment

Definition – Natural Resources – Classification – Conservation – Deveopment of Public Water Supply – Need for protected water supply – Per Capital consumption –Sanitation – Sewerage system – Disposal of Sewage – Kinds of pollution – their effects of human beings.

Reference Books

- 1) E.P. Odum, *Fundamental Ecology*. 3rd Edition, Saunders, 1971.
- 2) P. Colvinvaux, *Ecology*. John Wiley & Sons, 1986.
- 3) Agarwal & S.V.S. Rana., *Environment and Natural Resources*. Society of Biosciences, 1985.

- 4) K.N. Duggal, *A Text book on Public Health Engineering*. S. Chand & Co, Ramnagar, New Delhi, 1994.

(C) Health Sciences

Unit-I

Physical Health – Introduction to health – Food, Meaning of balanced diet, Sources, Common nutritional deficiencies and prevention.

Personal Health – Cleanliness of body, Care of Skin, Nails, Eye, Hair, Oral Health, Clothing, Body Posture and good habits such as exercises – Importance of avoiding smoking, alcoholism, drugs etc.

Population explosion and Family Planning – Importance, Common Methods of family planning for Men & Women.

Mothers and Children – Immunisation of children (importance, schedule) care of mothers during pregnancy and after delivery.

Communicable Diseases – Symptoms and prevention.

Unit-II

(i) Mental Health – Factors for maintenance of good mental health. (ii) Adolescent problems. (iii) First Aid (iv) Environment – Ventilation, Lighting, Simple methods of purification of water, Sanitary latrine, Prevention of Worm infestation (round worm, hook worm).

Reference Books

- 1) Murray Grant, *Hand Book of Community Health*, Philadelphia: Lea & Febiger Publications, 1987.
- 2) Lawrence B.Chenoweth, et al. *Community Hygiene*, New York: F.S.Croft's & Co. 1934.
- 3) Charles Frederic Boldman, et.al. *Public Health and Hygiene*, Philadelphia: W.B. Saunders Company, 1936.
- 4) Harold S.Diehl, *Text Book of Healthful Living*, New York: McGraw Hill, 1945.

ICHT 14 - Inorganic, Organic and Physical Chemistry - I

Unit-I : Atomic Structure and Periodic Properties

Atomic orbitals, quantum numbers, shapes of s, p and d orbitals. Aufbau principle, Pauli exclusion principle. Hund's rule. Electronic configuration of atoms. Screening effect. Effective nuclear charge. Calculation of effective nuclear charge using Slater rules. Periodic classification of elements based on electronic configuration. Atomic and ionic radii. Ionization energy, Electron affinity and electronegativity. Trends in periodic table.

Unit-II: Study of s block elements I – Hydrogen and alkali metals

Hydrogen – preparation, properties and uses - hydrogen as a fuel - Isotopes of hydrogen.

Alkali metals – Electronic structure, sizes of atoms and ions. Chemical properties: Oxides, hydroxides, peroxides and superoxides, hydrides and halides of alkali metals.

Compounds of Li, Na and K - preparation, properties and uses of LiCl, Li_2CO_3 , washing soda, baking soda, sodium nitrite, sodamide, KI and KCN.

Unit-III : Formation and Characters of Covalent Bond Involving Carbon

Types of hybridization of carbon. Structures of methane, ethane, ethylene and acetylene. C-C bond lengths in ethane, ethylene and acetylene. Inductive effect, resonance, hyperconjugation, aromaticity, classification of organic compounds. Types of organic reactions. Types of intermediates like carbocations, carbanions and radicals. Factors influencing the stabilities of intermediates.

Unit-IV : Alkanes, Alkenes and Alkynes

Nomenclature. Methods of preparation of alkanes – physical properties and chemical reactions of alkanes. Mechanism of free radical halogenation of alkanes – reactivity and regioselectivity.

Methods of preparation of alkenes. Mechanism of dehydration of alcohols and dehydrohalogenation of alkyl halides. Saytzeff rule. Hofmann's rule. Physical properties and chemical reactions of alkenes. Markovnikov's rule – Hydroboration – epoxidation – ozonolysis – hydroxylation.

Oxidation, reduction and polymerization. Uses of ethylene and propene. Cumulative, conjugated and isolated double bonds. 1,3 Butadiene, 1,4-addition. Diels – Alder reaction, polymerization reactions of butadiene.

Unit–V : Gaseous and Liquid States

Kinetic theory of gases. Deviation from ideal behaviour van der Waals equation of state. PV isotherm of real gases. Continuity of state. Critical phenomena – critical constants for a van der Waals gas. Law of corresponding states – reduced equation of state. Qualitative idea of structure of liquids. Structure of nematic and cholesteric phases. Applications of liquid crystals.

Text Books and References

- 1) J.D. Lee, Concise Inorganic Chemistry, Blackwell Science Ltd, London, 2006.
- 2) B.R. Puri, L.R. Sharma, K.K. Kalia, Principles of Inorganic Chemistry, Shoban Lal Nagin Chand & Co. New Delhi, 1995.
- 3) I.L.Finar, Organic Chemistry, Volume 1, 6th Ed., Longman Scientific and Technical, England, 1973.
- 4) B.S.Bahl, Arun Bahl, Advanced Organic Chemistry, S. Chand & Co. Ltd., New Delhi, 1996.
- 5) B.R. Puri, L.R. Sharma, S.Pathania, Principles of Physical Chemistry, Shoban Lal Nagin Chand & Co. New Delhi, 1995.
- 6) Ira N.Levine, Physical Chemistry, Mc Graw Hill, 1995.
- 7) S.H. Maron, C.F. Prutton, Principles of Physical Chemistry, Macmillan, 1990.

ICHA 15 - Mathematics – I

Unit – I

Series, Comparison test, Integral test, Comparison of ratios, D'Alembert's ratio test, Cauchy's root test, Alternating series, Convergence of exponential series, Uniform convergence.

Unit – II

Matrix operations, Rank of a matrix, Normal form of a matrix, Inverse of a matrix, Eigen values and Eigen vectors, Caley-Hamilton theorem, Reduction to a diagonal form.

Unit - III

Expansion of $\sin n\theta$, $\cos n\theta$, $\tan n\theta$ in powers of $\sin \theta$, $\cos \theta$ and $\tan \theta$, Exponential function of a complex variable, circular function of a complex variable, Hyperbolic functions, Inverse hyperbolic functions.

Unit - IV

Differentiation, Successive differentiation, Meaning of derivative.

Unit – V

Maxima and minima, Rolle's theorem and Mean value theorem, Expansions of functions, Partial differentiation.

Text Book:

- 1) Content and treatment as in the book "Higher Engineering Mathematics" by B.S. Grewal, Khanna Publishers, 2008.
 - Unit I Chapter 9 Sections 9.3 to 9.17 except 9.14
 - Unit II Chapter 2 Sections 2.5 to 2.9 and 2.14 to 2.17
 - Unit III Chapter 19 Section 19.6 to 19.11
- 2) Content and treatment as in the book "Calculus" Vol. I by S. Narayanan and T.K. Manicavachogam Pillay, S. Viswanathan Printers, 2009.
 - Unit IV Chapters 2, 3 and 4

Unit V Chapters 5, 6, 7 and 8 (Sections 1.1 to 1.7)

Reference Books:

1. G.B.Thomas, R.L.Finney, Calculus and Analytic Geometry, Addison Wesley, 9th Edn., Mass. (Indian Print) 1998.
2. M.K.Venkataraman, Engineering Mathematics-Part B. National Publishing Company, Chennai, 1992.

ICHA 15 - Allied Botany I: Plant Diversity, Anatomy and Embryology

Unit – I

General account of bacteria – ultrastructure, nutrition and nutritional types, reproduction- Asexual and parasexual. Economic importance.

Viruses: Structure- ultrastructure of TMV, Bacteriophage, reproduction of viruses.

Unit – II

Structure, Reproduction and Life history of *Nostoc*, *Oedogonium*, *Ectocarpus* and *Polysiphonia*, *Albugo*, *Pencillium* and *Agaricus*.

Unit – III

Structure, Reproduction and Life history of *Funaria*, *Lycopodium* and *Cycas*.

Unit – IV

Anatomy – simple and Complex tissues, Internal structure of Dicot root, stem and leaf - Monocot stem and leaf. Normal secondary thickenings of dicot stem.

Unit – V

Embryology – Microsporogenesis – Male gametophyte, Megasporesogenesis (*Polygonum* Type) – types of ovule, double fertilization, Types of endosperms.

Practicals:

1. To make suitable micropreparations, describe and identify the specimens of Algae, Fungi, Bacteria, Viruses, Bryophytes, Pteridophytes and Gymnosperms prescribed in theory syllabus.
2. Study of Anatomical features of leaf, stem and root of dicots and monocots
3. Study of different types of anther, LS of ovule.

Books:

1. S.S. Bhojwani, S.P. Bhatnagar, Embryology of Angiosperms, Vikas Publications PVT Ltd., New Delhi, 1981.
2. S.N. Pandey, Plant Anatomy, S.Chand & Company, New Delhi, 2009.
3. A.V.S.S.Sambamoorthy, A Textbook of Algae, I.K.International Pvt Ltd., New Delhi, 2005.
4. O.P. Sharma, Textbook of Algae, Tata McGraw Hill Publications Pvt Ltd., New Delhi, 2007.
5. B.R. Vashista, Textbook of Fungi, S.Chand & Company, New Delhi, 2009.
6. B.R.Vashista, A.K.Sinha, Adarsh Kumar, Botany for Degree Students, Bryophyta. S. Chand & Company, New Delhi, 2005.
7. B.R. Vashista, Textbook of Pteridophyta, S.Chand & Company, New Delhi, 2008.

SECOND SEMESTER

Part – I : Language - Tamil - தமிழ் தாள் - 2

ITAC- 21 – செய்யுளும் உரைநடையும்

அலகு - 1 - குறுந்தொகை

பாடல் எண்கள்:- 3, 6, 16, 18, 24, 28, 32, 37, 40, 54, 57, 60, 69, 74, 77, 83, 85, 93, 97, 99

(இருபது பாடல்கள் மட்டும்)

அலகு - 2- புறநானூறு

பாடல் எண்கள்:- 9, 19, 27, 34, 38, 45, 51, 55, 66, 71, 76, 82, 86, 92, 96

(பதினைந்து பாடல்கள் மட்டும்)

அலகு - 3 - திருக்குறள்

அன்புடமை, செய்நன்றி அறிதல், அடக்கமுடைமை, புறங்கூறாமை, ஈகை, அருளுடைமை (ஆறு அதிகாரங்கள் மட்டும்)

நாலடியார் - கல்வி, அறிவுடைமை (நாலடியார்)

அலகு - 4 - கம்பராமயணம்

குகப்படலம் (அயோத்தியா காண்டம்)

அலகு - 5 - உரைநடை

மா. பெரியசாமி தூரன் - சிற்பி. பாலசுப்பிரமணியன்
காப்பியத்திறன் - சோம. இளவரசு

பார்வை நூல்கள்

1. குறுந்தொகை - உ. வே. சா. பதிப்பு
2. புறநானூறு - உ. வே. சா. பதிப்பு
3. திருக்குறள் - பரிமேலழகர் உரை
4. கம்பராமயணம் - அண்ணாமலைப் பல்கலைக்கழகப் பதிப்பு
5. குறுந்தொகைச் சொற்பொழிவுகள்
6. குறுந்தொகைத் திறனாய்வு - சோ. ந. கந்தசாமி
7. எட்டுத்தொகைச் செல்வம் - லெ. ப. கரு. இராமநாதன் செட்டியா
8. மா. பெரியசாமி தூரன் - சிற்பி. பாலசுப்பிரமணியன், சாகித்ய அகாதெமி, முதற்பதிப்பு- 2000
9. காப்பியத்திறன் - சோம. இளவரசு - மணிவாசகர் பதிப்பகம், சென்னை.

IENC 22 – English Thorough Literature – II**Unit - I**

1. William Shakespeare “Sonnet 29”
2. William Blake “A Poison Tree”
3. Robert Bridges “A Red, Red Rose”

Unit - II

4. PB Shelley “Ozymandias”
5. Alfred Tennyson “The Brook”
6. HillaireBellock “Matilda”

Unit - III

7. Robert Fros “Stopping by Woods on a Snowy Evening”
8. Walt Whitman “O Captain, My Captain”
9. Sylvia Plath “Mirror”

Unit - IV

10. Toru Dutt “The Lotus”
11. A. K. Ramanujan “A River”
12. Keki N. Daruwala “Pestilence in Nineteenth Century Calcutta”

Unit - V

13. Gabriel Okara “Once Upon a Time”
14. Maki Kureshi “The Kittens”
15. Robert Finch “Peacock and Nightingale”

Text Book: S. Karthik Kumar, V.Gnanaprakasam, G.Arputhavel Raja, C.Shanmugasundaram, R.Vijaya, *English Through Literature: Poetry.*

ICEC 23 - Computer Applications - I

Unit – I

Introduction to computers, Applications of computers, Concepts of data and information, A typical computer system, Memory concepts, History of computers, Types of computers.

Input, output devices, data storage devices, software, the definition, the role of software, house keeping.

Unit – II

The computer internals, typical PC configuration, booting, virus, antivirus, vaccine, versions of software.

Operating system, definition, classification, basics of MSDOS, introduction to windows operating system, features of windows OS, desktop and desktop icons, starting programs, browsing and managing windows explorer, setting, Taskbars and creating shortcuts.

Unit – III

Introduction to internet, client server basics, E-mail, Telnet and Archie, FTR – Gopher, Jughead and Veronica, WAIS and world wide web, fundamentals of HTML, TCP / IP and E – Commerce.

Unit – IV

Issues involved in web site management, addressing, designing web sites with front page.

Unit – V

Multimedia, concept, requirements, applications and future, hardware and software requirements for Multimedia development and delivery platforms, multimedia methodologies fundamental and use of hypertext, hypermedia, sound, images, animation, video.

Using multimedia, multimedia interface, planning and development of multimedia projects.

Text Books & References

1. Ron Mansfield, Osborne, Windows 95 for Busy People, McGraw Hill, 1997.
2. Ron White, How computers work, BPB, 2016.
3. Christian Crumlish – The ABCs of the Internet.
4. Alexies Leon and Mathews Leon “Internet in a nutshell” Leon Press, Chennai and Vikas Publishing House, New Delhi.
5. Tay Vaughan, Multimedia Making it work, Osborne, Tata McGraw Hill, 1996.
6. Computer fundamentals and Windows with Internet Technology by Krishnan, Scitech Publications Pvt Ltd, Chennai, India.
7. Windows and MS-Office 2000 with database concepts, by Krishnan, Scitech Publications Pvt Ltd, Chennai, India.

ICHT 24 - Inorganic, Organic and Physical Chemistry - II

Unit – I : Study of s block elements II - Alkaline Earth Metals

Electronic structure – sizes of atoms and ions. Chemical properties – Oxides, hydroxides, peroxides, nitrides, carbides, hydrides and halides of alkaline earth metals comparison of Be and Mg with other alkaline earth metals – Comparison of alkaline earth metals with alkali metals - Plaster of paris, Portland cement – Hardness of water.

Unit – II : Arene, Alkyl Halides and Aryl Halides

Nomenclature of benzene derivatives. Isolation of benzene from coal tar. Mechanism of electrophilic substitution. Activating and deactivating substituents. orientation, effect of substituents.

Preparation, physical properties and chemical reactions of alkyl halides. SN_1 and SN_2 mechanisms. Manufacture, properties, reactions and uses of $CHCl_3$ and CCl_4 , vinyl chloride, allyl chloride and chlorobenzene. Relative reactivities of alkyl, aryl, vinyl and allyl halides.

Unit – III : Alcohols and Phenols

Alcohols: Classification: Monohydric alcohols – nomenclature, methods of formation by reduction of aldehydes, ketones, carboxylic acids and esters. Hydrogen bonding. Acidic nature. Reactions of alcohols.

Dihydric alcohols – nomenclature, methods of formation, chemical reactions of vicinal diols, oxidative cleavage by $Pb(OAc)_4$ and HIO_4 and pinacol-pinacolone rearrangement. Glycerol – manufacture, properties, reactions and uses.

Phenols : Nomenclature, structure and bonding. Preparation of phenols, physical properties and acidic character. Comparative acidic strengths of alcohols and phenols, Reactions of phenols – electrophilic aromatic substitution, acylation and carboxylation. Gattermann synthesis, Houben – Hoesch reaction and Reimer – Tiemann reaction.

Unit – IV : Chemical Kinetics and Catalysis

Rate of a chemical reaction. Factors influencing rates of chemical reactions. Order and molecularity. Rate equations for zero-, first- and second-order reactions. (For second order reaction with equal and unequal concentrations of reactants). Half life period. Determination of order of reaction- differential method, method of integration, half life period method, isolation method. Method of following kinetics by titrimetric procedures. Acid- and base- catalysed hydrolysis of ester and iodination of acetone as examples. Arrhenius equation, concept of activation energy. Simple collision theory. Catalysis, characteristics of catalysed reactions, classification of catalysts.

Unit – V : Thermodynamics - I

Definition of system and surroundings. Types of systems, thermodynamic properties - intensive and extensive properties. State and path functions - Concept of heat and work – thermodynamic equilibrium – reversible and irreversible processes.

First law of thermodynamics: statement - heat capacities at constant volume and constant pressure, relationship between C_p and C_v .

Joule's law – Joule-Thomson coefficient and inversion temperature. Calculation of w , q , dU & dH for the expansion of ideal gases under isothermal and adiabatic conditions for reversible process.

Thermochemistry: standard state, standard heat of formation – Hess's Law of heat summation and its applications. Heat of reaction at constant pressure and at constant volume. Heat of neutralization - temperature dependence of heat of chemical reaction – Kirchoff's equation.

Text Books & References

- 1) J. D. Lee, Concise Inorganic Chemistry, Blackwell Science Ltd., London, 2006.
- 2) B.R. Puri, L.R. Sharma, K.K. Kalia, Principles of Inorganic Chemistry, Shoban Lal Nagin Chand & Co. New Delhi, 1995.
- 3) I.L. Finar, Organic Chemistry, Volume 1, 6th Ed., Longman Scientific and Technical, England, 1973.
- 4) B.S. Bahl, Arun Bahl, Advanced Organic Chemistry, S. Chand & Co. Ltd., New Delhi, 1996.
- 5) Jerry March, Advanced Organic Chemistry, John Wiley, 1994.
- 6) K.J. Laidler, Chemical Kinetics, Tata McGraw Hill, 1973.
- 7) G.L. Agarwal, Basic Chemical Kinetics, Tata McGraw Hill, 1990.
- 8) B.R. Puri, L.R. Sharma, S. Pathania, Principles of Physical Chemistry, Shoban Lal Nagin Chand & Co. New Delhi, 1995.

- 9) J. Rajaram, J.C. Kuricose, Thermodynamics for Students of Chemistry, Shoban Lal Nagin Chand & Co. New Delhi, 1986.
- 10) S. Glasstone, Thermodynamics for Chemists; Affiliated East West Press, 1974.

ICHP 25 : Practical – I: Volumetric Analysis

- 1) Acid-base Titrations:
 - a) Determination of NaOH and Na₂CO₃ in a mixture by double titration.
 - b) Estimation of Barium Chloride
 - c) Determination of ammonium ion
- 2) Redox Titrations:
 - a) Permanganometry – Estimation of ferrous and ferric ions in a mixture
 - b) Estimation of oxalic acid and oxalate ion.
 - c) Dichromatory – Estimation of Fe²⁺ and Fe³⁺ ions
 - d) Iodometry – Estimation of copper
- 3) Precipitation Titration: Determination of chloride

Book: A. I. Vogel, Text book of Quantitative Inorganic Analysis, CBS Publishers, 1969.

ICHA 26 - Mathematics – II

Unit - I Integration

Introduction, Definite integral, Methods of integration, Integrals of the form

$$\begin{array}{lll}
 \text{(i) } \int \frac{f'(x)}{f(x)} dx & \text{ii) } \int F\{f(x)\}f'(x) dx, & \text{(iii) } \int \frac{dx}{ax^2+bx+c} dx \\
 \text{(iv) } \int \frac{lx+m}{ax^2+bx+c} dx & \text{(v) } \int \frac{1}{\sqrt{ax^2+bx+c}} & \text{(vi) } \int \frac{px+q}{\sqrt{ax^2+bx+c}} dx
 \end{array}$$

Unit - II Integration

Properties of definite integrals, Integration by parts, Reduction formula for the following types

$$\begin{array}{ll}
 \text{(i) } I_n = \int x^n e^{ax} \quad n \rightarrow +ve \text{ integer} & \text{(ii) } I_n = \int \cos^n x dx \quad n, \text{ positive integer} \\
 \text{(iii) } I_n = \int \sin^n x dx & \text{(iv) } I_{m,n} = \int \sin^m x \cos^n x dx \text{ Bernoulli's formula.}
 \end{array}$$

Unit - III

Area under plane curves, Area of a closed curves, Area between two intersecting curves, Areas in polar coordinates, Volume of the solid of revolution, Length of a curve, Area of surface of revolution.

Unit – IV

Vector differentiation, Scalar functions, Vector functions, Differentiation of a vector, Differentiations formulas, Differentiation of dot and cross products, The Vector differential operator Del, Gradient of a scalar function, Directional derivatives, Divergence of a vector, Curl of a vector, Expansion formulae, Second order differential operators, Solenoidal and irrotational fields.

Unit – V

Vector integration, The line integral, Green's theorem in two dimensions-verification, Gauss divergence theorem (without proof)-verification and evaluation of integrals, Stoke's theorem (without proof)-verification and evaluation of integrals.

Text Book:

- 1) Content and treatment as in the book “Calculus (Major)” Vol. II by S. Narayanan and T.K. Manicavachogam Pillay, S. Viswanathan Printers, 2003.

Unit I	Chapter 1 Sections 1 to 8
Unit II	Chapter 1 Sections 11 to 15.1
Unit III	Chapter 2 Sections 1.1 to 1.4, Sections 3 to 5

- 2) Content and treatment as in the book “Vector Calculus and Fourier Series” by M.K. Venkataraman and Manorama Sridhar, by The National Publishing Company, 2002.

Unit IV Chapter 2 Sections 2.2 to 2.4, 2.6, 2.7.

Chapter 3 Sections 3.2, 3.3, 3.4, 3.7, 3.9, 3.11, 3.12, 3.15.

Unit V Chapter 4 Sections 4.1, 4.3, 4.9 and 4.12

Reference Books:

- 1) G.B.Thomas, R.L.Finney, Calculus and Analytic Geometry, Addison Wesley, 9th Edn, Mass, (Indian Print, 1998.
- 2) M.K.Venkataraman, Engineering Mathematics-Part B. National Publishing Company, Chennai, 1992.
- 3) P. R.Vittal, Vector Calculus, Fourier series and Fourier Transform, Margham Publications, Chennai, 2004.
- 4) B.S. Grewal, Higher Engineering Mathematics, Khanna Publishers, 2008.

ICHA 26 - Allied Botany II: Taxonomy, Physiology, Ecology and Biotechnology

Unit – I - Outline the classification of natural system- Bentham and Hooker, A detailed study of following families and their economic importance: *Annonaceae*, *Zygophyllaceae*, *Caesalpiniae* and *Cucurbitaceae*

Unit – II

A detailed study of following families and their economic importance: *Rubiaceae*, *Apocynaceae*, *Lamiaceae*, *Nyctaginaceae*, *Cannaceae* and *Poaceae*

Unit – III Physiology

Absorption of water, absorption of minerals, photosynthesis- photo system I and Photo system II, C₃ C₄ and CAM pathways. Respiration- Glycolysis, TCA cycle and electron transport system, Pentose phosphate pathway. Growth Hormones- Physiological effects of growth substance – Auxins, Gibberellins and Cytokinins.

Unit – IV Ecosystem

Biotic and Abiotic components – Food chain – food web – Energy Flow. Plant Ecology: Factors affecting vegetation- abiotic and biotic. Morphological and anatomical adaptations in hydrophytes and *Xerophytes*.

Unit – V Plant Biotechnology

Enzymes (restriction enzymes, DNA Ligase). Cloning vectors (Plasmid, Cosmid, Tiplasmid). Production of rDNA. Production of Transgenic plants. Tissue culture techniques (Aseptic conditions, MS media and Callus induction)

Books

1. R.M. Devlin, Plant Physiology, PWS Publishers, Boston, 1996.
2. R.C. Dubey, A Textbook of Biotechnology, S.Chand & Company, New Delhi, 2009.
3. S.C. Dutta, Systematic Botany, New Age International Pvt. Ltd., New Delhi, 2003.
4. V.K. Jain, Fundamentals of Plant Physiology, S.Chand & Company, New Delhi, 2008.
5. B.P. Pandey, Taxonomy of Angiosperms, S.Chand & Company, New Delhi, 2009.
6. A.V.S.S. Sambamoorthy, Molecular Biology, Narosa Publishers, New Delhi, 2005.
7. R.S. Shukla, R.S. Chandel, Plant Ecology, S.Chand & Co. Pvt.Ltd, New Delhi, 1998.

ICHP 27 - Ancillary Botany Practical – I

1. Detailed study of families mentioned in the theory with one representative specimen from the local Flora

2. Simple experiments and experimental set up in Plant Physiology section of the syllabus.
3. Study of anatomical structure of Hydrophytes and Xerophytes.

THIRD SEMESTER

Part – I : Language - Tamil - தமிழ் தாள் - 3

ITAC- 31 - உரைநடையும் நாடகமும்

நோக்கம்: இலக்கியங்களின் சிறப்புகளையும் கருத்துகளையும் உரைநடை வழியாகப் புலப்படுத்தல் - உரைநடை திறனை எடுத்துரைத்தல்

அலகு- 1

இலக்கிய விளக்கம் - ஆசிரியர் (வ. சு. ப. மாணிக்கம்)

இலக்கிய விளக்கம் - இலக்கணக் குறள்கள் - வரிசைப்பாட்டு - வாழ்வாங்கு- தூய

இலக்கியம் - நடைமுறை அறங்கள் - இலக்கியக்கலை

அலகு- 2

குறளணிகள் - இலக்கிய வெள்ளம் - தன்நெஞ்சம் - இலக்கியத்தளம் - குறள் விளக்கம் - நம்பிக்கை நூல் - நீதி விளக்கம்

அலகு- 3

மா. ப. பெரியசாமித்தூரன் - (ஆசிரியர் - சிற்பி. பாலசுப்பிரமணியன்)

வாழ்வும் பணியும் - அன்பில் திளைத்த கவிதை - சிறுகதைப் படைப்புகள்

நாடகங்களும் கீர்த்தனைகளும் - கட்டுரைச் செல்வம்

அலகு- 4

சிறுவர் இக்கியம் அறிவியல் நூல்களும் பிறவும் - கலைக்களஞ்சியப் பணி - பாரதி தமிழ் - தூரன் என்றொரு மனிதர்.

அலகு- 5

நாடகம் - தோகை வண்ணம் (ஆசிரியர் - டாக்டர் ச. சுவகர்லால்)

பார்வை நூல்கள்

1. வ. சு. ப. மாணிக்கம் - இலக்கிய விளக்கம் மணிவாசகர் பதிப்பகம், முதற்பதிப்பு- 1971
2. சிற்பி. பாலசுப்பிரமணியன் & மா. ப. பெரியசாமித்தூரன் - சாகித்ய அகாதெமி, முதற்பதிப்பு 2000
3. டாக்டர் ச. சுவகர்லால் - தோகை வண்ணம், பழனியம்மாள் வெளியீடு, சென்னை, முதற்பதிப்பு 2008 ஐங்கரன் அடுக்ககம், சையச்சாத் அவென்யூ - விருகம்பாக்கம், சென்னை-92.

IENC 32 - English through literature - III

Unit -I

Stanley Houghton "The Dear Departed"

Kenneth Sawyer Goodman "The Game of Chess"

Unit -II

A. A. Milne "The Princess and the Woodcutter"

Anton Chekhov "A Marriage Proposal"

Unit -III

Arnold Bennett "The Stepmother"
Arthur Miller "Grandpa and the Statue"

Unit -IV

William Shakespeare King Lear (Act I, Scene i)
William Shakespeare Julius Caesar (Act III, Scene ii)

Unit -V

Frances Goodrich & Albert Hackett The Diary of Anne Frank (Act I)
Betty Keller "Tea Party"

Text Book: S.Florence, G.Aruna Devi, R.Rajamohan, S. Bhuvanewari, M. Soundararajan, *English Through Literature: Drama.*

ICHT 33 - Inorganic, Organic and Physical Chemistry – III

Unit – I : Chemical Bonding

Ionic bonding: Formation and general properties. Radius ratio rule and its limitations. Hydration energy and lattice energy and their applications. Born-Haber cycle. Fajan's rules.

Covalent bond: Valence bond theory. Formation and general properties. Orbital overlap. Hybridization, sigma and pi bonds, VSEPR theory and geometries of H₂O, NH₃, CH₄, PCl₅, SF₆, IF₇, BF₃ molecules.

Partial ionic character of covalent bond and percentage of ionic character.

Molecular Orbital theory: Bonding and anti-bonding molecular orbitals, bond order.

MO diagrams of H₂, Ne₂, O₂, O₂⁺, O₂⁻ and CO.

Unit – II : Acids, Bases and Non Aqueous Solvents

Bronsted definition, Lewis definition, Lux-Flood definition – Usanovich's generalized definition – K_a, K_b, pK_a and pK_b for Bronsted acids and bases. Relative strengths of Bronsted acids and bases- pH of Buffer solution- Henderson's equation. Theory of acid base indicators.

Non-aqueous solvents, liquid NH₃, liq.SO₂ and HF.

Unit – III : Ethers, Epoxides, Aldehydes and Ketones

Preparation, properties and chemical reactions of ethers with special reference to diethyl ether. Uses of diethyl ether. General methods of preparation of epoxides. Preparation, properties and chemical reactions of ethylene oxide. Polar nature of carbonyl group. Nomenclature of aldehydes and ketones. Important methods of preparation of aldehydes and ketones. Reactions and Industrial applications of aldehydes and ketones with special reference to formaldehyde, acetaldehyde, benzaldehyde, acetone, acetophenone and benzophenone.

Unit – IV : Carboxylic Acids and their Derivatives

Nomenclature. Important methods of preparing carboxylic acids. Reactions of carboxylic acids with special reference to formic acid, acetic acid and benzoic acid. Halogenated acids: chloroacetic acid, α-chloro and β-chloro propionic acid. Hydroxyacids: glycollic acid, lactic acid, tartaric acid, malic acid and citric acid. Preparation, properties and reactions of carboxylic acid derivatives with special reference to acetyl chloride, acetic anhydride, acetamide, ethyl acetate, benzoyl chloride and benzamide. Unsaturated acids: Acrylic acid and Crotonic acid. Dicarboxylic acids: oxalic acid, succinic acid and phthalic acid.

Unit – V : Electrochemistry - I

Electrical transport. Conduction in metals and in electrolyte solutions. Specific conductance and equivalent conductance. Measurement of equivalent conductance. Variation of equivalent and specific conductances with dilution.

Migrations of ions. Kohlrausch law. Arrhenius theory of electrolyte dissociation and its limitations. Weak and strong electrolytes. Ostwald's dilution law, its uses and limitations. Debye-Huckel-Onsager's equation for strong electrolytes. (elementary treatment only). Transport number: definition and determination by Hittorf method and moving boundary method.

Applications of conductivity measurements: determination of degree of dissociation, determination of K_a of acids, determination of solubility product of a sparingly soluble salt and conductometric titrations.

Text Books and References

- 1) B.R. Puri, L.R. Sharma, K.K. Kalia, Principles of Inorganic Chemistry, Shoban Lal Nagin Chand & Co. New Delhi, 1995.
- 2) J. D. Lee, Concise Inorganic Chemistry, Blackwell Science Ltd., London, 2006.
- 3) F.A. Cotton, G. Wilkinson, P.L.Gaus, Basic Inorganic Chemistry, 3rd Edition, 2004.
- 4) I.L. Finar, Organic Chemistry, Volume 1, 6th Ed., Longman Scientific and Technical, England, 1973.
- 5) R. T. Morrison, R.N. Boyd, Introduction to Organic Chemistry, Prentice Hall of India, 1992.
- 6) B.R. Puri, L.R. Sharma, S.Pathania, Principles of Physical Chemistry, Shoban Lal Nagin Chand & Co. New Delhi, 1995.
- 7) S. Glasstone, An Introduction to Electrochemistry, Affiliated East West Press, 1971.

ICHP 34 : Practical II - Inorganic Qualitative Analysis

Analysis of mixture containing two cations and two anions of which one will be an interfering ion. Semi micro methods using the conventional scheme with hydrogen sulphide may be adopted.

Cations to be studied: Lead, Copper, Bismuth, Cadmium, Iron, Aluminium, Zinc, Manganese, Cobalt, Nickel, Barium, Calcium, Strontium, Magnesium and Ammonium.

Anions to be studied: Carbonate, Sulphide, Sulphate, Nitrate, Chloride, Bromide, Fluoride, Borate, Oxalate and Phosphate.

Reference Book : V.V.Ramanujam, Semi micro Qualitative analysis, National publishers, 1995.

ICHA 35 : Ancillary II - Physics – I

Unit - I: Mechanics

Centre of gravity – Definition - General formula for the determination of centre of gravity of a hollow hemisphere, solid hemisphere and solid cone.

Floatation: Laws of floatation - Stability of floating bodies - Metacentre - Determination of metacentric height of a ship.

Unit - II: Relativity

Introduction - Definition of Relativity - Special theory and general theory of relativity -Newtonian relativity - Frame of reference - Galilean transformation equations - Derivation-The Michelson - Morley experiment - Explanations of negative result - Lorentz transformation equations - Derivation - Length contraction -Time dilation - Addition of velocity - Variation of mass with velocity - Mass - Energy equivalence.

Unit - III: Solid State Physics

Elements of crystallography - Different features of crystals - Symmetry operation-Symmetry elements - Space lattices - lattice constants - Miller indices - Reciprocal lattices- Crystal structures of Diamond and NaCl.

Super conductors : Nature and occurrence - Meissner effect - Type I and Type II superconductors - superconducting magnet - Applications of superconductors.

Unit - IV: Nuclear physics

Properties of nucleus (size, mass, binding energy, spin and parity) - Particle detectors - G.M.Counter - Wilson cloud chamber - Bubble chamber.

Nuclear models : Liquid drop model - Shell model.

Nuclear Energy : Nuclear fission - Fusion - Self sustained fission reaction - Nuclear fission in stars - Carbon - Nitrogen cycle - Proton - Proton cycle - Thermonuclear reaction - Nuclear reactor.

Unit - V: Digital Electronics

Decimal, Binary, Octal and hexadecimal number systems and their mutual conversions - Basic logic gates - OR, AND and NOT - Universal gates - NOR and NAND - Boolean algebra - Demorgan's theorem - Verification using truth table.

Text Books and References

1. D.S.Mathur, Mechanics, S.Chand and Co., 2006.
2. R.Murugasen, Modern Physics, S.Chand and Co., 2008
3. S.L.Gupta, V.Kumar, Solid State Physics, Kedarnath and Ramnath and Co., 1970.
4. M.L.Pandya, P.R.S.Yadav, Elements of Nuclear Physics, Kadanath, 1993.
5. R.P.Jain, Modern Digital Electronics, Tata McGraw Hill, 2006.

FOURTH SEMESTER

Part – I : Language - Tamil - தமிழ் தாள் - 4

ITAC- 41 - தமிழ் இலக்கிய வரலாறு

நோக்கம் : தமிழ் இலக்கிய வளர்ச்சி வரலாற்றினை விவரித்து தமிழ் இலக்கியங்கள் குறித்து அறிமுகம் செய்தல்

அலகு- 1 : சங்க காலம், சங்க மருவிய காலம்

தொல்காப்பியம் - சங்க காலம் - முற்சங்கங்கள் - பாட்டும் தொகையும் - தொகுப்பு முறை- சிறப்புகள்- சங்கப் புலவர்கள்- தொல்காப்பியம்- பதினெண்கீழ்க்கணக்கு நூல்கள், முற்காப்பியங்கள்.

அலகு-2 : பல்லவர், சோழர் காலம்

சைவ இலக்கியங்கள்- பன்னிரு திருமுறைகள்- வைணவ இலக்கியங்கள்- நாலாயிர திவ்வியபிரபந்தம் -ஐஞ்சிறு காப்பியங்கள் - கம்பராமாயணம் - பெரியபுராணம் - பிற இலக்கியங்கள்

அலகு-3 : நாயக்கர் காலம்

சிறுஇலக்கியங்கள் - அந்தாதி தூது - மாலை - கோவை - பரணி - கலம்பகம் - உலா - பிள்ளைத்தமிழ் - கோடை - பள்ளு - குறவஞ்சி - அருணகிரிநாதர் - குமரகுருபரர் -காளமேகப்புலவர் - சிவப்பிரகாசர் - தனிப்பாடல்கள்.

அலகு-4 : ஐரோப்பியர் காலம்

உரைநடை வளர்ச்சி - தாயுமானவர் பாடல்கள் - மீனாட்சி சுந்தரம் பிள்ளை - இராமலிங்க அடிகள் - வேதநாயகம் பிள்ளை - கிறித்தவர்களின் தமிழ்ப்பணி - இஸ்லாமியர்களின் தமிழ்த் தொண்டு - நாடகத் தமிழ் - மனோன்மணியம் சுந்தரம் பிள்ளை - பம்மல் சம்பந்த முதலியார் - சூரியநாராயண சாஸ்திரியார் - பிறர்.

அலகு-5

மரபுக்கவிதை - பாரதியார்- பாரதிதாசன்- கவிமணி- நாமக்கல் கவிஞர் வாணிதாசன், முடியரசன் - கண்ணதாசன். ஊரைநடை- பரிதிமாற்கலைஞர்- உ. வே. சா.- மறைமலை அடிகள்- எஸ்.வையாபுரிப்பிள்ளை- ரா. பி. சேதுபிள்ளை- திரு. வி. க.- மு. வ- வ. சுப. மாணிக்கம்- சிறுகதை- புதமைப் பித்தன்- கு. ப. ரா - லா. சா. ரா. - கு. அழகிரிசாமி- தி. ஜா -சுந்தரராமசாமி

– விந்தன் - மு. வ- நாவல் - மாயூரம் வேதநாயகம்பிள்ளை – மாதவையா – கல்கி- அகிலன்- தி. ஜனகிராமன்- நா. பார்த்தசரதி, வல்லிக்கண்ணன், பசுவையா, சி. மணி, ஞானக்கூத்தன், வானம்பாடி இயக்கம்- நா. காமராசன், சிற்பி, மேத்தா, மீரா- அறிவியல் தமிழ் - இணையத்தமிழ்

பார்வை நூல்கள்

1. மு. வரதராசன்- தமிழ் இலக்கிய வரலாறு, சாகித்ய அகாடெமி வெளியீடு 1998
2. புவண்ணன் - தமிழ் இலக்கிய வரலாறு, கழக வெளியீடு சென்னை.
3. தமிழண்ணல் - புதிய நோக்கில் தமிழ் இலக்கிய வரலாறு, மீனாட்சி புத்தகாநிலையம், 1998.
4. சி. பாலசுப்பிரமணியன் - தமிழ் இலக்கிய வரலாறு, பாரி நிலையம், சென்னை. 1987
5. எம். ஆர். ஆடைக்கலசாமி- தமிழ் இலக்கிய வரலாறு, கழக வெளியீடு சென்னை 1994
6. மது. ச. விமலானந்தம் - தமிழ் இலக்கிய வரலாற்றுக் களஞ்சியம், 1987.

IENC 42 – English through Literature - IV

Unit - I

1. O' Henry "After Twenty Years"
2. Ernest Hemingway "A Day's Wait"

Unit - II

1. Flora Annie Steel "Valiant Vicky"
2. Oscar Wilde "The Selfish Giant"

Unit - III

1. R. K. Narayan "An Astrologer's Day"
2. ShashiDeshpande "I Want"

Unit - IV

1. Leo Tolstoy "Where Love is God is"
2. Somerset Maugham "The Ant and the Grasshopper"

Unit - V

1. Chinua Achebe "Marriage is a Private Affair"
2. Bessie Head "Heaven is not Closed"

Text Book: A.Selvaraj, P.Dinakaran, M. Madhavan, K. Ganeshram, SP.Shanthi, *English Through Literature: Short Story.*

ICHT 43 - Inorganic, Organic and Physical Chemistry - IV

Unit – I : Metallurgy

Occurrence of metals. Extraction and concentration of ore. Various methods of concentration of ore. Various processes involved in metallurgy such as calcination, roasting, smelting, zone refining and froth flotation. Various types of reductions of metallic oxides into metals. Types of furnaces used in metallurgy. Reverberatory furnaces and blast furnace. Extraction of titanium, vanadium, chromium, iron and copper from their ores. Refining of metals-Electrolytic refining, Zone refining. Important physical and chemical properties of Ti, Th, U, Pb, Zn, Al, Fe and Cu. Important alloys of Ti, V, Cr, Pb, Zn, Al, Fe and Cu with special reference to steel and alloy steels.

Unit – II : Organic Compounds of Nitrogen

Preparation and reactions of nitroalkanes with special reference to nitromethane. Preparation and reactions of nitrobenzene. Preparation and reactions of aliphatic and aromatic nitriles with special reference to CH_3CN and $\text{C}_6\text{H}_5\text{CN}$. Primary, secondary and tertiary amines. Methods of preparation of amines. Separation of a mixture of primary, secondary and tertiary amines. Reactions of amines with special reference to methylamine, ethylamine, dimethylamine, diethylamine, triethylamine, aniline, N-methylaniline and N,N-dimethylaniline. Preparation and reactions of benzene diazonium chloride.

Unit – III : Stereochemistry of Organic Compounds

Asymmetric carbon. Optical activity and optical isomerism. Enantiomers and their representation by Fischer projection and flying wedge formula. R-S notation. Isomerism in compounds with two asymmetric carbons. Meso and dl-forms of tartaric acid and their representation by Fischer projection formula and flying wedge formula. Geometrical isomerism about C=C bond. Reason for high energy barrier to rotation about C=C bond. Geometrical isomerism of fumaric and maleic acids. E – Z notation. Use of dipole moment in differentiating E and Z 1,2-dihalogenoethenes (with same halogen on both carbons).

Unit – IV : Thermodynamics - II

Second law of thermodynamics: Need for the law, different statements of the law. Carnot cycle and its efficiency, Carnot theorem. Thermodynamic scale of temperature. Concept of entropy: Entropy as a state function, entropy as a function of V & T, entropy as a function of P & T, entropy change during physical change, Clausius inequality, entropy as a criteria of spontaneity and equilibrium. Entropy change in ideal gases and mixing of gases.

Third law of thermodynamics: Nernst heat theorem, statement and concept of residual entropy, evaluation of absolute entropy from heat capacity data.

Gibbs function (G) and Helmholtz function (A) as thermodynamic quantities. A and G as criteria for the thermodynamic equilibrium and spontaneity Variation of G and A with P, V and T.

Unit – V : Colloidal State and Adsorption

Definition and classification of colloids.

Sols: Kinetic, optical, electrical properties and stability of sols. Protective action. Hardy-Schulze law. Gold number.

Emulsions: Types of emulsions. Preparation. Emulsifier. gels: classification, preparation and properties. Applications of colloids.

Difference between adsorption and absorption. Physical and chemical adsorptions. Freundlich adsorption isotherm and its experimental verification. Adsorption indicators.

Text Books and References

- 1) B.R. Puri, L.R. Sharma, K.K. Kalia, Principles of Inorganic Chemistry, Shoban Lal Nagin Chand & Co. New Delhi, 1995.
- 2) Jerry March, Advanced Organic Chemistry, John Wiley, 1994.
- 3) E.C. Eliel, Stereochemistry of Carbon Compounds, Tata Mc- Graw Hill, 1960.
- 4) R. T.Morrison, R.N. Boyd, Introduction to Organic Chemistry, Prentice Hall of India, 1992.
- 5) J. Rajaram, J.C. Kuricose, Thermodynamics for Students of Chemistry, Shoban Lal Nagin Chand & Co. New Delhi, 1986.
- 6) B.R. Puri, L.R. Sharma, S.Pathania, Principles of Physical Chemistry, Shoban Lal Nagin Chand & Co. New Delhi, 1995.
- 7) N. Kundu, S.K. Jain, Physical Chemistry, S.Chand and Co. Ltd., 1984.
- 8) W.J. Moore, Physical Chemistry, Longmann Press, 1988.

ICHP 44 : Practical III - Preparation and Analysis of Organic Compounds

Preparations

Single step preparation involving reactions such as nitration, bromination, hydrolysis and acetylation.

Qualitative Analysis

- a) Detection of N,S and Cl in organic compounds
- b) Characterization of organic compounds as acidic, basic and neutral
- c) Differentiation of organic compounds as saturated, unsaturated and aromatic and non-aromatic

- d) Finding the presence of the following functional groups in organic compounds containing only one such functional group – phenolic, carboxyl, dicarboxyl, ester, nitro, amide, ketone, aldehyde
- e) Analysis of carbohydrates (reducing and non-reducing)

ICHA 45 - Ancillary Physics - II

Unit - I: Atomic Physics

Atom model: Bohr, Sommerfeld's and vector atom models -The Pauli's exclusion principle - Various quantum numbers.

X-Rays: Production and properties of X-rays - Bragg's law - Bragg's X-ray spectrometer - Moseley's law - Compton Scattering.

Unit - II: Laser

Principle - Experimental arrangement - Population inversion - Laser pumping – Two level system and three level system - Ruby laser - Helium - Neon laser - Applications of laser.

Unit - III: Polarization

Polarization - Brewster's Law -Huygen's explanation of double refraction in uniaxial crystals - polarizing prisms - Quarter and half wave plates - Production and detection of a plane, circularly and elliptically polarized light.

Optical Activity – Fresnel's explanation of rotation - Fresnel's experiment - Specific rotation - Determination of specific rotatory by Laurent's half - Shade polarimeter.

Unit – IV: Basic Electronics

Zener diode - Characteristics of zener diode - Uses of zener diode -Characteristics of FET and UJT – Principles of LED and LCD – Oscillators – Hartley and Colpitt's oscillators (quantitative) – Relaxation oscillators – Fundamentals of astable, bistable and monostable multivibrators.

Unit – V: Nuclear Physics

Nuclear detectors – Ionization Chamber – Proportional counter –Scintillation counters.

Particle accelerators – Van de Graaff generator – Linear accelerator – Cyclotron – synchro cyclotron – Betatron.

Text Books and References

1. R.Murugesan, Kirthiga Sivaprasath, Modern Physics, S.Chand and Co., 2008.
2. B. B Laud, Lasers and Non-linear Optics, 2nd edition, Wiley, 1991.
3. N. Subrahmanyam, Brijlal, M.N.Avadhanulu, A Text book of Optics, S.Chand and Co., 2004.
4. G.K. Mittal, Applied Electronics, Khanna Publishers, 1968.
5. V.K. Mehta, Shalu Mehta, Principle of Electronics, S. Chand & Co.,1980.
6. D.C. Tayal, Nuclear Physics, Himalaya Publishing House, 1995.

ICHP 46 - Ancillary Physics Practical

List of Experiments (Any Sixteen only)

1. Young's Modulus – Non uniform pendulum
2. Rigidity modulus of wire – Torsion pendulum.
3. Surface tension of a liquid by drop weight method.
4. Comparison of Viscosities of two liquids.
5. Specific heat capacity by cooling.
6. Thermal conductivity – Lee's disc.
7. Sonometer – Verification of Laws.
8. Spectrometer – Solid prism.
9. Spectrometer – Grating.

10. Newton's rings.
11. Field along the axis of a coil.
12. P.O box – Temperature Co-efficient.
13. Calibration of low range – Voltmeter – Potentiometer.
14. Calibration of Ammeter - Potentiometer.
15. Figure of merit of galvanometer – Direct deflection method.
16. Thermo emf – Direct method
17. Single stage R.C coupled amplifier.
18. Half and Full wave Rectifier.
19. Characteristics of Junction, Zener diodes.
20. Logic Gates.

FIFTH SEMESTER

ICHT 51 - Organic Chemistry - I

Unit – I : Nomenclature – Electron Displacements

Rules of IUPAC nomenclature – nomenclature of condensed carbocyclic and aromatic systems – heterocyclic rings (containing one, two and three hetero atoms) - Fused ring systems.

Unit – II : Preparation and Synthetic uses of Malonic Esters, Ethyl acetoacetate and Grignard Reagents : Carbanions in organic synthesis – Malonic ester - preparation and synthetic application - synthesis of carboxylic acids –heterocyclic compound. Preparation of acetoacetic ester – acid hydrolysis and ketonic hydrolysis – synthetic applications of acetoacetic ester - preparation of alkyl magnesium halides and their synthetic applications.

Unit – III : Conformational Analysis

Conformations of ethane, n-butane, 1,2-dichloroethane and 1,2-ethanediol - relative stabilities of gauche and anti conformations – Representation of conformations of 1,2-disubstitutedethanes, meso- and dl-tartaric acids, erythro- and threo-1,2-dibromo-1-phenylpropane by Newman projection and Sawhorse formulae. Conformation of cyclohexane and its monosubstituted derivatives, conformational energy of a substituent, OH, CH₃, CH₃CH₂, CH(CH₃)₂ and C(CH₃)₃. Energy difference between chair and boat conformations. Types of hydrogens in chair and boat conformations.

Unit – IV : Heterocyclic Compounds

Five membered heterocyclic compounds – furan, thiophene and pyrrole – six membered heterocyclic compounds – pyridine – structure – source, electrophilic substitution, reactivity and orientation – nucleophilic substitution in pyridine. Comparison of basicity of pyridine – piperidine and pyrrole. Synthesis of quinoline, isoquinoline and indole. Special reference to Fischer - Indole and skrup synthesis.

Unit – V : Alkaloids and Terpenoids

General methods of structure elucidation of alkaloids and terpenoids – classification of terpenoids – isoprene rule – structure and synthesis of piperine and nicotine.

Structure and synthesis of citral, geraniol and α -terpineol.

Text Books and References

1. L. N.Ferguson, The Modern Structural theory of Organic Chemistry, Prentice Hall of India, 1966
2. I. L. Finar, Organic Chemistry, Volume 1 & 2, Longman Scientific and Technical, England, 1973.
3. E. L. Eliel, Stereochemistry of Carbon Compounds, Tata Mc Graw Hill, 1960.
4. P.S. Kalsi, Organic Reactions and their Mechanism, New Age International Publishers, 2000.
5. D. Nasipuri, Stereochemistry of Organic Compounds, New Age International, 1991.
6. P.L. Soni, Text book of Organic Chemistry, S.Chand Publications, New Delhi, 29th Edition, 2012.
7. O.P. Agarwal, Natural Products, Vol. I & II, Goel Publishing, 1997.

8. R. T. Morrison, R.N. Boyd, Introduction to Organic Chemistry, Prentice Hall of India, 1992.

ICHT 52 - Inorganic Chemistry - I

Unit – I : Nature of Bonding of Main Group Elements

Types of compounds and E – H, E – X, E – O and E – N bond types for B, C, N, Si, P and S, element – element single and multiple bonds, catenation and heterocatenation – polysilanes and polyphosphazenes, alkali and alkaline earth metal complexes of alkylamines, alkaloids and calixerenes; Electron deficient, precise and electron rich compounds, fullerenes – types and structures, carbon nanotubes.

Unit – II : Metallic Bonding

Packing of atoms in metals [BCC, CCP, HCP] – Theories of metallic bonding. Drude & Lorentz theory – Sommerfield free electron theory – Block theory – Band theory, Alloy systems: Classification – Substitutional and interstitial solid solutions – Lave Zintl phases – Alloys of two true metals (Cu – Au systems) – Alloys of a true metal and B – Sub group element – System of type T₂B compounds – Hume – Rothery rules – Theoretical basis of Hume – Rothery rules.

Unit – III : Study of p- Block Elements

Nitrogen family, comparative study of N, P, As, Sb and Bi elements- oxides, oxyacids, halides, hydrides. Structure and uses of hydrazine, hydroxylamine, hydrazoic acids- Preparation and uses of NaBiO₃ - Nitrogen fertilizers.

Oxygen family- comparative study of O, S, Se, Te elements-catenation- Chemistry of ozone- Hydrides, oxides, oxyacids of Sulphur including peroxy acids and thionic acids.

Properties of Halogens - Halogen oxides-Oxoacids - Interhalogen compounds.

Noble gases: Electronic configuration - reason for placing in zero group position in the periodic table-Chemical inertness of noble gases – reasons - applications - Clathrates and compounds of Xenon.

Unit – IV : Chemistry of d and f Block Elements

Chemistry of d-block elements – characteristics of d block elements – variable valency – magnetic properties and colour – comparative study of Ti, V, Cr, Mn and Fe group metals – occurrence, oxidation states, magnetic properties and colour – preparation and uses of ammonium molybdate, V₂O₅ and VF₆.

Chemistry of f-block elements – comparative account of lanthanides and actinides, occurrence, elements oxidation states, magnetic properties colour and spectra – lanthanide contraction – causes, consequences and uses – comparison between 3d and 4f block elements.

Unit – V : Nuclear Chemistry – I

Nuclear properties: Nuclear radii, Spin and moments – Nuclear structure: n-p ratio in stable and metastable nuclei, nuclear forces – Nuclear models: liquid drop, shell and collective models.

Modes of radioactive decay: α and β decay, Radioactive decay constant. Radioactive equilibrium, Orbital electron capture, nuclear isomerism, internal conversion – Detection and determination of radioactivity – Cloud chamber, Nuclear emulsion, Bubble chamber, Proportional counter, Geiger – Muller counter, scintillation and Cherenkov counters - particle accelerators : linear, cyclotron, synchrotron, betatron and bevatron.

Text Books and References

1. H.J. Arnikar, Essentials of Nuclear Chemistry, New Age International, 1995.
2. S. Glasstone, Source Book on Atomic Energy, Affiliated East – West Press, 1967.
3. J.E. Huheey, Inorganic Chemistry, Addison Wesley, 1993.
4. F.A. Cotton, G. Wilkinson, Advanced Inorganic Chemistry, Wiley Eastern, 1988.
5. G.T. Seaborg, Man Made Elements, Prentice Hall, 1963.
6. G. Friedlander, J.W. Kennedy, N.M. Miller, Nuclear and Radio Chemistry, John Wiley, 1981.
7. R. C. Evans, An Introduction to Crystal Chemistry, Cambridge University Press, 1964.

ICHT 53 - Physical Chemistry - I

Unit – I : Electrochemistry - II

Types of reversible electrodes – Metal – metal ion, metal – insoluble salt – anion, glass and redox electrodes. Electrode reactions, Single electrode potential, Nernst equation, galvanic cell, E.M.F and its measurement, calculation of thermodynamic parameters from E.M.F. standard hydrogen electrode, use of calomel as reference electrode, standard electrode potential and its determination, electrochemical series and its significance, Reversible and irreversible cells, conventional representation of electrochemical cells, polarization, overpotential and hydrogen overvoltage.

Unit – II : Phase Equilibrium

Equilibrium between two phases of one component, Clapeyron equation and Clausius-Clapeyron equation - applications.

Statement and meaning of the terms – phase, component and degree of freedom, derivation of Gibbs phase rule, phase equilibria of one component system – water, CO₂ and sulphur systems.

Phase equilibrium of two component system – simple eutectic Bi-Cd and Pb - Ag systems, compound formation and formation of solid solution, phase diagram for Fe-C system.

Unit – III : Binary Systems

Solution, concentration units - molarity, molality and normality – ideal solution ΔH , ΔV , ΔS thermodynamics of ideal solution ΔH_{mix} , ΔV_{mix} and ΔS_{mix} .

Binary liquid systems, Raoult's law, vapour pressure of ideal solution, deviations from ideal behaviour – vapour pressure – composition curves and temperature – composition curves. Fractional distillation of binary liquid solution, azeotropic distillation. Partially miscible liquid pairs – phenol – water, triethylamine-water and nicotine-water systems CST and effect of impurities on CST – Immiscible liquids - Theory and application of steam distillation – Solution of gases in liquids – factors influencing the solubility of gas in a liquid, Henry's law.

Unit – IV : Colligative Properties

Theory of dilute solutions – colligative properties – lowering of vapour pressure, osmotic pressure, elevation of boiling point and depression of freezing point - basic explanation - Thermodynamic derivation of elevation of boiling point and depression in freezing point – determination of molecular mass from boiling point measurements, freezing point measurements and osmotic pressure measurements – abnormal molar mass and van't Hoff factor – distribution law – distribution coefficient – condition for the validity of the distribution law and thermodynamic derivation – association and dissociation of the solute in one of the solvents.

Unit – V : Physical Properties and Molecular Structure

Electric polarization – dipole moment of a diatomic molecule – induced dipole moment – atom polarization, electron polarization and orientation polarization – Clausius - Mossotti equation (no derivation) – measurement of dipole moment in gas phase and in solution – dipole moment and structure of simple molecules.

Rotational spectrum of diatomic molecules: rotational energy, rotational quantum number, degeneracy factor, relative populations of various levels, selection rules for rotational transition, rotational spectrum, calculation of bond length, simple problems.

Text Books and References

1. S. Glasstone, Text Book of Physical Chemistry, Mac Millan, 1956.
2. B.R. Puri, L.R. Sharma, S.Pathania, Principles of Physical Chemistry, Shoban Lal Nagin Chand & Co. New Delhi, 1995.
3. W.J. Moore, Physical Chemistry, Longmann, 1988.
4. N. Kundu, S.K. Jain, Physical Chemistry, S. Chand and Co. Ltd., 1984.

5. S. Glasstone, An Introduction to Electrochemistry, Affiliated East West Press, 1971.

ICHT 54 - Analytical Chemistry

Unit – I : Basic concepts of analytical chemistry

Role of Analytical Chemistry. Classification of analytical methods – classical and instrumental. Types of instrumental analysis. Selecting an analytical method - Neatness and cleanliness - Laboratory operations and practicals - Analytical balance - Techniques of weighing, errors, Volumetric glassware-cleaning and calibration of glassware. Sample preparations – dissolution and decompositions. Gravimetric techniques. Selecting and handling of reagents. Laboratory notebooks. Safety in the analytical laboratory.

Unit – II : Errors and their Evaluation

Definition of terms mean and median. Precision-standard deviation, relative standard deviation. Accuracy-absolute error, relative error. Types of errors in experimental data-determinate (systematic), indeterminate (or random) and gross. Sources of errors and the effects upon the analytical results. Methods for reporting analytical data. Statistical evaluation of data-indeterminate errors. The uses of statistics.

Unit – III : Titrimetric Analysis

Theoretical considerations of titrimetric analysis – classification of reactions in titrimetric analysis – standard solutions – concentration units – primary and secondary standards – Neutralisation indicators – apparent indicator constant – universal or multiple – Range indicators. Neutralisation curves – Neutralisation of strong acid with strong base, weak acid with strong base, weak base with strong acid, weak acid with weak base and polyprotic acid with strong base. precipitation titrations, redox titrations, self indicators, external indicators, starch, EMF as an indicator of End Point.

Complexometric titration, EDTA titrations, EBT and murexide indicator. Titrations in non-aqueous solvents – solvents for non-aqueous titrations - Indicators for non-aqueous titrations.

Unit– IV : Gravimetric Analysis

Principles of gravimetric analysis – characteristics of precipitating agents – choice of precipitants and conditions of precipitation – specific and selective precipitants – DMG, cupferron, salicylaldehyde, ethylene diamine – use of sequestering agents – co precipitation – post precipitation – peptisation – differences reduction of error – precipitation from homogeneous solutions – calculations in gravimetric methods – use of gravimetric factor.

Thermal analytical methods – Principle involved in thermogravimetric analysis and differential thermal analysis.

Unit – V : Separation Methods

Solvent extraction: Principles and process of solvent extraction – Distribution law and the partition coefficient – Batch extraction – Continuous extraction.

Classification of chromatographic methods, Principles of differential migration and adsorption phenomenon – Nature of the adsorbent solvent systems – R_f values – Paper chromatography – various modes of development: ascending, descending and horizontal, Detection of spots – Two dimensional - reversed phase and preparative paper chromatography, Thin layer chromatography – Coating materials – Preparation of plates – Solvents for development and detection – Preparative TLC - Application – Column chromatography: Adsorption and partition methods: Nature of the column materials, preparation of the column, solvent system and detection methods.

Text Books and References

1. G.D.Christian, Analytical Chemistry, 5th Ed., John Wiley, 1994.
2. D.A.Skoog, D.M.West, F.J.Holler, W.B. Saunders, Fundamentals of Analytical Chemistry.
3. J.H.Kennedy, W.B.Saunders, Analytical Chemistry: Principles.

4. L.G.Hargis, Analytical Chemistry: Principles and Techniques, Prentice Hall, 1988.
5. D.A.Skoog, J.L.Loary, W.B.Saunders, Principles of Instrumental Analysis.
6. D.A.Skoog, W.B.Saunders, Principles of Instrumental Analysis.
7. R.A.Day, Jr. and A.L.Underwood, Qualitative Analysis, Prentice Hall.
8. S.M.Khopkar, Environmental Solution Analysis, Wiley Eastern
9. S.M.Khopkar, Basic Concepts of Analytical Chemistry, Wiley Eastern.
10. F.Settle, Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall.

ICHP 55 - Practical IV - Gravimetric Analysis

1. Estimation of sulphate as barium sulphate
2. Estimation of barium as barium sulphate
3. Estimation of barium as barium chromate
4. Estimation of lead as lead chromate
5. Estimation of silver as silver chloride
6. Estimation of calcium as calcium oxalate monohydrate
7. Estimation of calcium as calcium carbonate
8. Estimation of nickel as Ni-DMG complex
9. Estimation of zinc as zinc oxinate
10. Estimation of magnesium as magnesium oxinate.

SIXTH SEMESTER

ICHT 61 - Organic Chemistry - II

Unit – I : Carbohydrates

Classification of carbohydrates – Monosaccharides – structure of glucose and fructose. Reactions of glucose – tests for monosaccharides – osazone formation – lengthening of the carbon chain of aldoses – Kiliani – Fischer synthesis. Shortening of the carbon chain of aldoses – the Ruff degradation. Ring structure of glucose - mutarotation. Interconversion of glucose and fructose – An introduction to disaccharides (sucrose, maltose and lactose) and polysaccharides (starch and cellulose) without involving structure determination. deors and amino sugars.

Unit – II : Amino Acids and Proteins

Preparation of amino acids – reactions of amino acids – structure of amino acids – peptides – structure of peptides – Oxytocin and N- terminal residue analysis – synthesis of peptides. Protein – classification – colour tests – structure of proteins – primary, secondary and tertiary structures.

Unit – III : Polymers

Macromolecules – polymers – methods of polymerization – Addition chain – growth polymerization – free radical polymerization – ionic vinyl polymerization. Copolymerization – polymerization with Zeigler – Natta catalysts. Structure and properties of macromolecules. Uses of polymers.

Unit – IV : Synthetic Dyes, Fats, Oils and Detergents

Classification of dyes and synthesis of methyl orange, congo red, crystal violet, phenolphthalein.

Natural fats, edible and industrial oils of vegetable origin, common fatty acids, glycerols, hydrogenation of unsaturated oils, Saponification value, iodine value, acid value soaps, synthetic detergents, alkyl and aryl sulphonates.

Unit – V : UV and IR Spectra of organic compounds

Ultraviolet – Visible spectroscopy – types of electronic transitions – chromophores and auxochromes – factors influencing positions and intensity of absorption bands – absorption spectra of dienes, polyenes and α , β – unsaturated carbonyl compounds – Woodward – Fieser rules.

IR Spectroscopy – vibrational frequencies and factors affecting them – identification of functional groups – intra and inter molecular hydrogen bonding – finger print region – Far IR region – metal ligand stretching vibrations.

Text Books and References

1. P.L. Soni, Text Book of Organic Chemistry, S.Chand Publications, 29th Edition, 2012.
2. I.L. Finar, Organic Chemistry, Volume 1 & 2, Longman Scientific and Technical, 1973.
3. V.R. Gowarikar, N.V. Viswanathan, Polymer Science, New Age International, 1986.
4. P.C.Jain and M.Jain, Engineering Chemistry, Dhanpat Rai Publishing Company, 2009.
5. S.Venkataraman. Synthetic Dyes, Vol. I & II, Academic Press, 1952.
6. R. T. Morrison, R.N. Boyd, Introduction to Organic Chemistry, Prentice Hall of India, 1992.

ICHT 62 - Inorganic Chemistry - II

Unit – I : Coordination Compounds

Werner's coordination theory, Effective atomic number rule, Nomenclature of coordination compounds, Isomerism in coordination compounds, Chelates. Applications of coordination compounds, Complexometric titrations using EDTA, Application of valence bond theory to coordination compounds.

Unit - II: Nanophase Materials

Introduction – techniques for synthesis of nanophase materials –sol-gel synthesis-electrodeposition –inert gas condensation-mechanical alloying –properties of nanophase materials –applications of nanophase materials, composite materials: Introduction –types.

Unit – III : Thermodynamics of Inorganic Reactions

Basic principles of Thermodynamics – Kinetics and Spontaneity of reactions – Formal potential – Electromotive force diagram – Ellingham diagram - Latimer and Frost diagrams – Pourbaix diagram – Relation to spontaneity and application in the prediction of chemical reaction – Oxidation – reduction reactions in water as a function of pH.

Unit – IV : Analytical Applications of Chemical Equilibria

Acid-base equilibria – Common ion effect- Buffer solution – Solubility equilibria – Distribution equilibria – Complex ion equilibria – Factors influencing equilibria .

Principle of inorganic qualitative analysis: Reactions involved in the separation and identification of cations and anion in the analysis- Spot test reagents: Aluminon, Cupferon, DMG, thiourea, Magneson, Alizarin and Nessler's reagent-Semi micro techniques

Unit – V : Environmental Chemistry

Pollution and its control: Sources of air pollution CO_2 , Pb, CO, oxides of nitrogen and sulphur, Freons, smog – green house effect- global warming – methods of control.

Pollution of soil: Fertilizers, insecticides, solid waste and acid rain, methods to control.

Pollution of water: Industrial and domestic waste, effluents, sewage waste, Fertilizer, insecticides oil, toxic metal COD and BOD. Consequences – methods to control. Rain water harvesting – its need, methods and advantages.

Noise pollution and radioactive pollution – health hazards.

Text Books and References

1. J.E. Huheey, Inorganic Chemistry, Addison Wesley, 1993.
2. A.I.Vogel, A Text Book of Quantitative Inorganic Analysis,, ELBS, 1978.
3. R.L. Pecsok, L.D. Shields, Modern Methods of Chemical Analysis, New York, 1976.

4. B.E.Douglas, D.H.McDaniel, J.J.Alexander, Concepts and Models of Inorganic Chemistry, John Wiley and Sons, Blaisdell Publishing co., 1965.
5. D.F. Shriver, P.W. Atkins, Inorganic Chemistry, Langford – Oxford University Publication, 1994.
6. H. Uhlig, Corrosion and Corrosion Control, 4th Edition, John Wiley, 1985.
7. R.J.D. Tilley, Defect Crystal Chemistry and its Applications, Chapman Hall Publication, 1987.
8. L.F. Lindoy, The Chemistry of Macrocyclic Ligand Complexes, Cambridge University Press, 1990.
9. S.Emeleus, A.G. Sharpe, Modern Inorganic Chemistry, ELBS Publication, London, 4th edition, 1973.
10. S.M. Khopfar, Environmental Pollution Analysis, New Age International, 1993.
11. P.C. Jain, M.Jain, Engineering Chemistry, Dhanpat Rai Publishing Company, 2009.
12. Kenneth J. Klabunde, Nanoscale Materials in Chemistry, John Wiley & Sons Inc., 2004.

ICHT 63 - Physical Chemistry - II

Unit – I : Spectroscopy - I

Electromagnetic radiation, types of molecular spectra, microwave spectroscopy – rotational spectra of diatomic molecule, conditions for a molecule to be active in microwave region, rotational constants (B), selection rule for rotational transition. Infra red spectroscopy – vibrational spectra of diatomic molecule – harmonic and zero point - energy. Raman spectroscopy – Raleigh scattering and Raman scattering, stokes and antistokes lines in Raman spectra, Raman frequency, conditions for a molecule to be Raman active. UV spectroscopy – electronic transition in diatomic molecule, Franck-Condon principle, selection rule.

Unit – II : Photochemistry - I

Light absorption, Beer – Lambert law, its limitations. Laws of photochemistry – Grothus – Draper law, Stark – Einstein law, quantum yield and its determination, chemical actinometers, photochemical decomposition of HI, photochemical combinations of H₂ and Br₂, H₂ and Cl₂ reaction. Difference between photochemical and thermal reactions. Jablonski diagram – Fluorescence, phosphorescence, photosensitization – photosynthesis in plants.

Unit – III : Solid State

Classification of solids – isotropic and anisotropic crystals, laws of crystallography, representation of planes, miller indices, space lattice, crystal systems, seven primitive unit-cells. X-ray diffraction, derivation of Bragg's equation, determination of structure of NaCl by Debye Scherrer (powder) method and rotating crystal method, determination of Avagadro's number, discussion of structures of KCl & CsCl. Defects in crystals – stoichiometric and nonstoichiometric. Packing of ions in crystals – radius ratio rule and its limitations.

Unit – IV : Quantum Mechanics - I

Black body radiation, Planck's radiation law, photoelectric effect, Compton effect, Bohr's model of hydrogen atom (no derivation), its demerits, wave particle duality, de broglie equation, Heisenberg uncertainty principle, wave nature of electron, Schrodinger's time – independent wave equation (no derivation), wave function and its physical interpretation, Normalization and orthogonal function.

Unit – V : Polymer Science

Polymerization reaction, types of polymerization reactions, addition polymerization and condensation polymerization, mechanism of polymerization, kinetics of polymerization, molecular mass of polymers, number average and mass average molecular mass, determination of molecular mass by osmotic pressure measurement and sedimentation method – important physical properties of polymers.

Text Books and References

1. W.Levine, Quantum Chemistry, Prentice Hall, 1994.
2. A.K.Chandra, Introductory Quantum Chemistry, Tata Mc Graw Hill, 1997.
3. B.K. Sen, Quantum Chemistry, Tata Mc Graw Hill, 1995.

4. C.N. Banwell, Fundamentals of Molecular Spectroscopy, Tata McGraw Hill, 1993.
5. S. Glasstone, Thermodynamics for Chemists, Affiliated East Press, 1947.
6. J.Rajaram, J.C.Kuricose, Thermodynamics for Students of Chemistry, 3rd Ed., Shoban Lal Nagin Chand & Co, New Delhi, 1986.
7. K.K. Rostogi Mukerjee, Wiley Eastern, 1987.
8. W.J. Moore, Basic Physical Chemistry, Prentice Hall, 1986.
9. W. Billmeyer, Text book of Polymer Science, John Wiley & Sons, New York, 1984.

ICHT 64 - Pharmaceutical Chemistry

Unit – I Basic Pharmaceutical Chemistry

Definition of the following terms: drug, pharmacophore, pharmacology, Pharmacopeia, bacteria, virus and vaccine. Causes, symptoms and drug for anemia, jaundice, cholera, alaria and filarial. Indian Medicinal plants and uses – Tulasi, Neem, Kizhanelli, Mango, Semparuthi, Adadodai and Thoothvelai

Unit – II Antibacterials

Sulpha drugs-examples and actions-prontosil, sulphathiazole, sulphafurazole. Antibiotics-definition and action of penicillin, streptomycin, chloramphenicol, erythromycin-tetracyclin – SAR of chloramphenicol only. Antiseptics and disinfectans – definition and distinction – phenolic compounds, chlorocompounds and cationic surfactant.

Unit – III Analgesics and CNS stimulants

Analgesics: Definition and Actions – narcotic and non narcotic – morphine and its derivatives, pethidine and methodone – disadvantages and uses. Antipyretic analgesics - salicylic derivative, paracetamol, ibuprofen. Drugs affecting CNS – Definition, distinction and examples for tranquilisers, sedatives, hypnotics, psychedelic drugs – LSD, Hashish – their effects

Unit – IV Anesthetics and Drugs for Chronic diseases

Anaesthetics - definition – local and general – volatile nitrous oxide, ether, Chloroform, cyclo propane – uses and disadvantages – non – volatile intravenous – thiopental sodium, methohexitone, propanidid. Causes, medicines and their mode of action for the treatment of cancer – antineoplastics – diabetes – hypoglycemic agents AIDS – AZT, DDC. Blood: Grouping, composition, Rh factor, blood pressure, hyper tension and hypotension.

Unit – V Vitamins, Hormones and Enzymes

Vitamins – fat soluble vitamins – (i) vitamin A; (ii) vitamin D; (iii) vitamin B complex; (iv) vitamin C; (V) vitamin E; (vi) vitamin K; (vii) vitamin P. Hormones – Introduction, properties and function of hormones, chemical nature of hormones. Physiological function of some hormones: Adrenaline, thyroxin, oxytoxin, insulin, the sex hormones. Enzymes – Chemical nature of enzymes, classification of enzymes, properties of enzymes, mechanism of enzyme action. Action of Co-enzymes.

Text Books and References

1. Jayashree Ghosh, A Text Book of Pharmaceutical Chemistry, 3rd Edition, S.Chand & Company Ltd., New Delhi, 2003.

ICHP 65 : Practical V - Experiments in Physical Chemistry

1. Measurement of conductance-distinguishing strong electrolyte, weak electrolyte and non-electrolyte using conductivity measurement.
2. Determination of cell constant, specific conductance and equivalent conductance.
3. Conductometric titrations

- a) HCl vs NaOH, b) CH₃COOH vs NaOH, and c) CuSO₄ vs NaOH
4. Measurement of EMF of a galvanic cell and determination of single electrode potential of metal electrode and redox electrode.
 5. Determination of pH of a buffer solution using pH meter
 6. Determination of molecular weight by depression of freezing point methods
 - a) Rast method and b) Transition temperature method
 7. Construction of phase diagram of a simple eutectic system (Two component system)
 8. Partition coefficient for the distribution of iodine between different organic solvents and water
 9. Association factor of benzoic acid / acetic acid between benzene and water
 10. Kinetics of acid catalyst hydrolysis of ethyl acetate.

SEVENTH SEMESTER

ICHT 71 - Organic Chemistry – III

Unit - I Nomenclature, Aromaticity and Electronic Effects

IUPAC nomenclature of annulenes, condensed carbocyclic and aromatic ring systems, heterocyclic rings, polycyclic compounds, spiro compounds and crown compounds.

Non-benzenoid aromatic compounds - Huckel rule - aromaticity of annulenes, heteroannulenes and fullerenes.

Inductive and field effects- mesomeric and hyperconjugative effects – steric inhibition of resonance- influence on strengths of organic acids and bases. Hydrogen bonding and its effects.

Unit - II Organic Reaction Mechanisms - I

Types of organic reactions – Reaction intermediates – formation, structure and stability of carbocations, carbanions, radicals, carbenes and nitrenes.

Aromatic electrophilic substitution – mechanisms of nitration, halogenation and sulphonation reactions. Friedel-Crafts reaction and its modifications. Influence of Cl, Me, OH, NH₂, NHCOCH₃ and NO₂ on reactivity and orientation.

Electrophilic substitution of naphthalene – formation of two isomers – explanation of kinetic and thermodynamic controls by sulphonation of naphthalene.

Aliphatic nucleophilic substitution – S_N1, S_N2 and S_Ni mechanisms – simple examples.(Elementary idea only)

Esterification, hydrolysis and transesterification by acid-catalysed acyl oxygen fission mechanism – explanation of the principle of microscopic reversibility.

Unit - III Stereochemistry - I

Optical isomerism – chirality – asymmetry and dissymmetry - enantiotopic and diastereotopic hydrogens. Enantiomers and diastereomers and their representation by flywedge and Fischer projections – R,S notation

Conformational analysis of 1,2-disubstituted-ethanes – relative stabilities of gauche and anti conformations. Representations of the conformations of diastereomers with two asymmetric carbons using Newmann and Sawhorse projections – relative stabilities of diastereomers.

Geometrical isomerism about C = C bond – E-Z notation – determination of configuration of geometrical isomers – geometrical isomerism in acyclic oximes.

Unit - IV Organic Photochemistry – I

Photochemical reactions of saturated ketones – Norrish type-I & II reactions- photoreductions of ketones- Paterno-Buchi reaction- reaction of α,β unsaturated ketones- isomerisation and cycloadditions - photo reactions of cyclohexadienones.

Photochemical cis-trans isomerisation of simple alkenes – photochemical oxidation, oxidative couplings. Barton reaction.

Unit - V Natural Products - I

Alkaloids - Structure and important biological properties of quinine, papaverine, cocaine, atropine, nicotine and adrenaline – general methods of structural elucidation of alkaloids – structural elucidation and synthesis of papaverine and atropine.

Terpenoids – classification – isoprene rule and special isoprene rule – general methods of structural elucidation of terpenoids – structural elucidation and synthesis of camphor, zingiberene and vetivones.

Text Books and References

1. W. Billmeyer, A Text Book of Polymer Science, Wiley Interscience, 1984.
2. E.L. Eliel, Stereochemistry of Carbon Compounds, Tata McGraw Hill, 1962.
3. L.N. Ferguson, The Modern Structural Theory of Organic Chemistry, Prentice Hall, 1963.
4. I. L. Finar, Organic Chemistry, Vol. 1 & 2, ELBS, 1964.
5. P. J. Garrat, Aromaticity, McGraw Hill, 1971
6. R.D. Guthrie, J. Honeyman, An Introduction to the Chemistry of Carbohydrates, Clarendon Press, Oxford, 1964.
7. Jerry March, Advanced Organic Chemistry, Wiley – VCH, Weinheim, 2000.
8. D. Nasipuri, Stereochemistry of Organic Compounds, New Age International, 1991.
9. S.W. Pelletier, Chemistry of Alkaloids, Elsevier, 2001.

ICHT 72 - Inorganic Chemistry - III

Unit - I Molecular Structure

Molecular orbital theory, construction of molecular orbitals in diatomic molecules and triatomic molecules. Molecular orbitals in polar molecules, percentage of ionic character, Bond length and bond energy. Electronegativity - Alred–Rochow and Mulliken–Jaffe electronegativity scales - Group electronegativity, electro neutrality principle.

Structures of BeH_2 , $(\text{CH}_3)_3\text{B}$, COCl_2 , PF_5 , SF_6 , SF_4 , ClF_3 , $(\text{CH}_3)_3\text{P}$, XeF_6 and IF_7 based on VSEPR theory.

Unit - II Solid State Chemistry

Ionic bonding, Lattice energy, Born equation and its derivation, radius ratio rules, structures of some ionic crystals (NaCl , CsCl , Rutile, Wurtzite, Fluorite). Bonding and structures of electron deficient molecules like boranes and metal alkyls. Electrostatic forces – ion-dipole and dipole-dipole interactions, van der Waals forces.

Unit - III Coordination Chemistry - I

Coordination Chemistry of transition metal ions – Nomenclature – stability constants of complexes and their determination (pH metric and spectrophotometric methods). Factors influencing stability, stabilization of unusual oxidation states by complex formation.

Pearson's HSAB concept, Acid-base strength and hardness and softness. Symbiosis, theoretical basis of hardness and softness. Electronegativity and hardness or softness.

Stereoisomerism of co-ordination complexes.

Unit - IV Coordination Chemistry - II

Bonding in complexes: Metal–ligand bond. Crystal field theory – splitting of d – orbitals, CFSE. Evidence for CFSE. Factors affecting splitting, spectrochemical series, Limitations of CFT, ligand Field Theory, M.O. Theory

Distortions in octahedral complexes. Jahn-Teller distortion – spectral implications of Jahn-Teller distortions in transition metal complexes.

Unit - V Nuclear Chemistry

Radioactive decay and equilibrium. Nuclear Q – value – cross sections, types of reactions; fission and fusion; fission products and fission yields, Modes of radioactive decay: α - and β - decay, orbital electron capture, nuclear isomerism, internal conversion. Hot atom chemistry.

Radioactive techniques, tracer technique, neutron activation analysis, counting techniques such as Geiger Muller, ionization and proportional counters. Applications of nuclear science in agriculture and biology. Atomic power projects in India.

Text Book And References

1. H. J. Arnika, Essential of Nuclear Chemistry, New Age International, 1995.
2. D. Bannerje, Coordination Chemistry, Tata McGraw – Hill, 1993.
3. F. A. Cotton, G. Wilkinson, Advanced Inorganic Chemistry, Wiley Eastern, 1988.
4. B. E. Douglas. D. H. Mc Daniel, J. J. Alexander, Concepts and Models of Inorganic Chemistry, Blaisdell Publishing Company, 1965.
5. B.N.Figgis, Introduction to Ligand Field Theory, Wiley Eastern, 1976.
6. G. Friedlander, J.W. Kennedy, N.M. Miller, Nuclear and Radio Chemistry, John Wiley, 1981.
7. S. Glasstone, Source Book of Atomic Energy, Affiliated East West Press, 1967.
8. S.F.A. Kettle, Coordination Compounds, Publisher Thomas Nelson, 1969.
9. L. Pauling, The Nature of Chemical Bond, Cornell University Press, 1961.

ICHT 73 - Physical Chemistry - III

Unit - I Chemical Kinetics and Catalysis

Absolute Reaction Rate Theory in thermodynamic terms – Significance of entropy and volume of activation. Ionic reactions – primary and secondary salt effects - Acid-base catalysis – Bronsted relations, catalytic coefficients and their determination. Enzyme catalysis - Michaelis-Menten equation – Heterogeneous catalysis-Langmuir-Hinshelwood and Eley-Rideal mechanisms

General features of fast reactions – Study of fast reactions by flow methods

Unit - II Photochemistry and Radiation Chemistry

Jablonski diagram, primary and secondary processes, Quantum yield. Photosensitization, Chemiluminescence. Kinetics of collisional quenching – Stern Volmer equations. Photosynthesis, solar energy conversions. Semiconductor photocatalysis, flash photolysis, lasers.

Radiation Chemistry-linear energy transfer, G-value, dosimeters, radiolysis of water, solvated electrons.

Unit - III Group Theory

Symmetry operations, point groups, reducible and irreducible representations, orthogonality theorem. Construction of C_{2v} and C_{3v} character tables. Selection rules for IR and Raman spectra, procedure for determining symmetry of normal modes of vibration - hybrid orbitals in BF_3 , CH_4 , NH_3 and SF_6 .

Unit - IV Spectroscopy - II

Origin of Molecular spectra - rotational spectra - rigid rotor and non-rigid rotor – Effect of isotopic substitution. Vibrational spectra – harmonic and anharmonic oscillators – fundamental vibrations and overtones – hot bands. Vibrational-rotational spectra – P, Q, R branches. Electronic spectra of diatomic molecule – Potential energy curves – Franck-Condon Principle.

Raman spectra – theory – Selection Rules – Rotational Raman Spectra and Vibrational Raman Spectra. Mutual exclusion principle.

Unit - V Electrochemistry - III

Debye-Huckel-Onsager equation and its verification, conductance at high field and high frequency. Debye-Huckel limiting law.

Electrochemical cell reactions, Nernst equation – electrochemical series. Electrode-electrolyte interface – Electrokinetic Phenomena. Batteries, Fuel cells, corrosion and its prevention.

Text Books and References

1. G.L.Agarwal, Basic Chemical Kinetics, Tata McGraw Hill, 1990.

2. C.N.Banwell, Fundamentals of Molecular Spectroscopy, Tata McGraw Hill, 1993.
3. F. A. Cotton, Chemical Applications of Group Theory, Wiley Eastern, 1971.
4. S. Glasstone, An Introduction to Electrochemistry, Affiliated East West Press, 1971.
5. S. Glasstone, Text Book of Physical Chemistry, Mc Millan, 1956.
6. K. J. Laidler, Chemical Kinetics, Tata Mc Graw Hill, 1990.
7. W. J. Moore, Basic Physical Chemistry, Prentice Hall, 1986.
8. K. V. Raman, Group Theory and its Application to Chemistry, Tata McGraw Hill, 1994.
9. K.K. Rohatgi Mukherjee, Fundamentals of Photochemistry, Wiley Eastern, 1987.

EIGHTH SEMESTER

ICHT 81 - Organic Chemistry – IV

Unit - I Stereochemistry- II

Walden inversion, asymmetric induction and asymmetric transformation - enantio and diastereo selective synthesis – enantiomeric excess and diastereomeric excess.

Atropisomerism of biphenyls, allenes and spiranes

Conformational analysis of cyclohexane and its mono-and di-substituted derivatives.

Unit - II Photochemistry – II

Classification of pericyclic reactions, electrocyclic reactions of 1,3-dienes, di-π methane rearrangement, sigmatropic rearrangement

Selection rules and stereochemistry of electrocyclic reactions, cycloadditions and sigmatropic shift, Sommet-Hauser, Cope and Claisen rearrangements

Unit - III Organic Reaction Mechanisms - II

Aliphatic electrophilic substitution - S_E1 , S_E2 and S_Ei mechanisms, electrophilic substitution with migration of double bond.

Aromatic nucleophilic substitution: Unimolecular, bimolecular and benzyne mechanisms.

Addition to carbon-carbon and carbon-oxygen multiple bonds – electrophilic and nucleophilic addition – addition to conjugated system. Hydration of olefins – Hydroboration

Elimination reactions: $E1$, $E2$, $E1cB$ & $E2C$ mechanisms – Pyrolytic eliminations – cis elimination - orientation of double bond – Bredt's rule, Hofmann & Saytzeff rules.

Unit - IV Natural Products - II

Structural elucidation of sucrose and maltose, structures of starch and cellulose - Amino acids – classification, general methods of preparation and general properties of amino acids.

Proteins – classification, primary structure of peptides, end group analysis.

Classification of enzymes and their specificity.

Ribonucleosides and ribonucleotides –RNA - types -structures of DNA and RNA.

Unit - V Synthetic Dyes and Polymers

Colour and constitution (Electronic concept). Classification of dyes, Chemistry and Synthesis of methyl orange, congo red, malachite green, crystal violet, phenolphthalein, fluorescein, alizarin and indigo

Polymers – Chemistry of polymerisation, Molecular weight and size, Kinetics of polymerisation, Chemical and geometrical structure of polymer molecules, Glass transition temperature, Crystallinity in polymers and Copolymerisation.

Text Book and References

1. S.P.Singh, S.M.Mukherjee, Organic Reaction Mechanisms, Macmillan, 1984.
2. P. Sykes, Guide Book to Mechanism in Organic Chemistry, Prentice Hall, 6th Edition, 1986.
3. R .K. Bansal, Organic Reaction Mechanisms, New Age international, 1996.

- F. A. Carey, R. J. Sunberg, *Advanced Organic Chemistry, Part A*, Springer, 5th Edition, 2007.
- I. L. Finar, *Organic Chemistry, Vol.II*, ELBS, 1977.
- E. L. Eliel, *Stereochemistry of Carbon Compounds*, Tata McGraw Hill, 1962.
- J.M.Coxton & B.Halton, *Organic Photochemistry*, Cambridge University Press, 2nd Edition, 2011.
- E.C.H. Depuy, O.S. Chapman, *Molecular Reactions and Photochemistry*, Prentice Hall, 1975.
- Stuart Warren, *Designing Organic Synthesis*, Wiley-VCH, 1982.
- R. O. C. Norman, *Modern Methods in Organic Synthesis*, Macmillan, 1967
- V. R. Gowariker, *Polymer Science*, New Age International (P) Limited, Publishers, 2005.

ICHT 82 - Inorganic Chemistry – IV

Unit - I Lanthanides and Actinides

Correlation of electronic structures, occurrence and isolation, separation - Chemistry of separation of Np, Pu & Am from U & fission products. Oxidation states and general properties – Comparison with ‘d’ block elements, Lanthanide contraction and its significance, Coordination compounds of lanthanides - Spectral and magnetic characteristics of lanthanides and actinides - Position in the periodic table. Similarities between the actinides and lanthanides

Unit - II Organometallic Chemistry - I

Synthesis and structure of metal complexes with alkenes and alkynes, bonding in such complexes, use of organometallic reagents in hydrogenation, hydroformylation, isomerisation and polymerization reactions.

Activation of small molecules by co-ordination.

Unit - III Bioinorganic Chemistry

Role of alkali and alkaline earth metals in biological systems and their transport across the membranes – Ionophores – Metalloporphyrins – cytochromes – ferredoxins. Physiology of myoglobin and haemoglobin – Dioxygen binding. Electron transfer, respiration and photosynthesis - PS-I, PS-II – Vitamin B₁₂ and B₁₂ coenzymes - Nitrogen fixation.

Unit - IV Organometallic Chemistry - II

Metal carbonyls – 18-Electron rule – M.O. theory, Polynuclear carbonyls with and without bridging groups – carbonylate anions – carbonyl hydrides – metal nitrosyls – dinitrogen complexes. Metallocenes: preparation, properties, structure and bonding of ferrocene like compounds. Complexes of cyclohexadienyl molecules.

Unit - V Photoinorganic Chemistry

Excited states of metal complexes – Energy transfer under conditions of weak interaction and strong interaction – exciplex formation. Conditions of the excited states to be useful as redox reactants - photosubstitution, photooxidation and photoreduction – photochemical reactions involving Ruthenium(II) –bipyridyl complex. Comparison with [Fe(bipy)₃]⁺² – Application to photovoltaics – Water photolysis – carbon dioxide reduction.

Text Books and References

- G. L. Ferraudi, *Elements of Inorganic Photochemistry*, Wiley Eastern, 1988.
- E. A.V. Ebsworth, D.W.H. Rankine, S.Craddock, *Structural Methods in Inorganic Chemistry*, ELBS, 1991.
- J. E. Huheey, *Inorganic Chemistry*, Addison Wesley, 1993.
- B.E.Douglas, D.H.McDaniel, J.J.Alexander, *Concepts and Models of Inorganic Chemistry*, John Wiley and Sons, Blaisdell Publishing co., 1965.
- F. A. Cotton, G. Wilkinson, *Advanced Inorganic Chemistry*, Wiley Eastern, 1988.
- L. Pauling, *The Nature of Chemical Bond*, Cornell University Press, 1961.

7. S.F.A. Kettle, Coordination Compounds, ELBS, 1975.
8. S.F.A. Kettle, Physical Inorganic Chemistry – A Coordination Chemistry Approach, Springer, 1992.
9. D.L.Nelson, M.M.Cox, Lehninger Principles of Biochemistry, W. H. Freeman and Co., 5th Edition, 2008.
10. G. N. Mukherjee, Elements of Bio-inorganic Chemistry, 4th Edition, U.N. Dhur and Sons, 1993.
11. G. L. Eichhorn, Inorganic Biochemistry, Elsevier Science Publication, 1973.
12. Vincenzo Balzani, Alberto Juris, Photochemistry and Photophysics of Ru(II) polypyridine complexes in the Bologna group. From early studies to recent developments, Coordination Chemistry Reviews, 211 (2001) 97-115.

ICHT 83 - Physical Chemistry - IV

Unit - I Thermodynamics - III

Calculation of adiabatic flame temperature, Maxwell's relations, thermodynamic equation of state, thermodynamics of open systems, partial molar quantities, chemical potential, Gibbs-Duhem equation, variation of chemical potential with temperature and pressure, third law of thermodynamics, Nernst heat theorem, chemical equilibrium-Van't Hoff reaction isotherm, standard free energy change of reactions, variation of equilibrium constant with temperature and pressure.

Unit - II Thermodynamics - IV

Fugacity of gases – determination of fugacity using graphical method and Van der Waals' equation – variation of fugacity with temperature and pressure. Concept of activity and activity coefficients – mean ionic activity and mean activity coefficients - determination of activity and activity coefficients using EMF measurements.

Non-equilibrium thermodynamics - conservation of energy and mass, entropy production – Microscopic reversibility and Onsager reciprocal relation. General application of non-equilibrium thermodynamics.

Unit - III Quantum Chemistry - I

Planck's quantum theory, wave particle duality, uncertainty principle, operators and commutation relations-Postulates of quantum mechanics – derivation of Schrodinger's time-independent wave equation and its application to particle in a one-dimensional box, particle in a three-dimensional box, harmonic oscillator, rigid rotor and hydrogen atom.

Unit - IV Quantum Chemistry - II

Covalent bonding – Born-Oppenheimer approximation-Hydrogen molecule ion, LCAO – MO and VB treatments of the hydrogen molecule. Antisymmetry and Pauli's exclusion principle. Slater determinantal wave function, term symbols and spectroscopic states – Russell-Saunders coupling.

Unit - V Material Science

Band theory - insulators, semiconductors and conductors and their applications - superconductors and their applications – A study of conducting polymers, liquid crystals, non-linear optical materials and photochromic materials and their applications.

Text Books and References

1. A.K. Chandra, Introduction to Quantum Chemistry, Tata McGraw Hill, 1997.
2. S. Glasstone, Thermodynamics for Chemists, Affiliated East West Press, New Delhi, 1960.
3. W. Levine, Quantum Chemistry, Prentice Hall, 1994.
4. S.H. Maron, C.F. Prutton, Principles of Physical Chemistry, McMillan, 1960.
5. W.J. Moore, Basic Physical Chemistry, Prentice Hall, 1986.
6. R. K. Prasad, Quantum Chemistry, Wiley Eastern, 1993.
7. J.C.Kuriacose, J. Rajaram, Thermodynamics for Chemistry, Shoban Lal Nagain Chand, New Delhi, 1986.

8. B.K. Sen, Quantum Chemistry, Tata McGraw Hill, 1992.

ICHP 84 : Practical VI - Organic Chemistry Practical – I

Preparations : Preparations involving reactions such as nitration, diazotisation, oxidation and reduction.

Qualitative Analysis : Analysis of two component mixtures. Separation and systematic analysis of two component mixtures.

ICHP 85 : Practical VII - Inorganic Chemistry Practical – I

Complexometric Titrations

- Standardisation of EDTA.
- Determination of Mg^{2+} , Zn^{2+} , Ni^{2+} and Ca^{2+}
- Hardness of water.

Semi Micro Qualitative Analysis

Mixture containing two common cations and two of the following less familiar cations. Se, Te, W, Mo, Be, Ti, Ce, Th, Zr, U, V, Tl and Li.

ICHP 86 : Practical VIII - Physical Chemistry Practical - I

I. Conductivity

- Determination of cell constant
- Determination of the solubility of sparingly soluble salt
- Verification of DHO equation – Equivalent conductance of strong electrolyte
- Dissociation constant of weak electrolyte (Verification of Ostwald's dilution law)

II. Conductometric titrations

- Acid-base titrations
 - HCl vs NaOH, ii) CH_3COOH vs NaOH, iii) $HCl + CH_3COOH$ vs NaOH
- Displacement titrations (NH_4Cl vs NaOH)
- Precipitation titrations
 - $CuSO_4$ vs NaOH, ii) $BaCl_2$ vs Na_2CO_3 , iii) KCl vs $AgNO_3$

III. Phase Rule : Two component system: Simple Eutectic

IV. Distribution Law

- Partition coefficient of iodine between two immiscible solvents
- Study of the equilibrium constant of the reaction : $KI + I_2 \rightleftharpoons KI_3$
- Distribution of ammonia between water and chloroform
- Determination of formula of cuprammonium complex

ICHT 87 - Statistical Methods

Unit – I

Definition, scope, functions and limitations of Statistics – Collection, Classification, Tabulation of data, Diagrammatic representation of data – Simple, Multiple and Percentage Bar diagram, Pie diagram and Graphical representation of data – Histogram, frequency polygon, frequency curve and ogives. Primary and Secondary data – Questionnaire method.

Unit – II

Measures of Central tendency – Mean, Median and Mode and their practical usages. Measures of Dispersion: Range, Quartile Deviation, Mean Deviation, Standard Deviation, Variance and Coefficient of Variation. Measures of Skewness – Pearson's, Bowley's method. Applications of Binomial and Normal distributions.

Unit – III

Measure of Bivariate data – Simple, Partial and Multiple Correlation. Scatter diagram and Pearson's method, Rank correlation. Regression and their equations – Prediction. Basic concept of Sampling – Parameter and Statistics – Sampling distribution and Standard Error – Simple random sampling and stratified random sampling.

Unit – IV

Tests of Significance with their important concepts. Tests for large samples - Test for mean, difference of means, proportion and equality of proportions. Small sample tests – Test for mean, difference of Means, paired samples, test for correlation and regression coefficients, Chi square test for goodness of fit and independence of attributes.

Unit - V

Applications and analysis using SPSS – Analysis of variance one way and two way classifications. Multiple regression analysis, Logistic regression analysis, Factor analysis, Cluster analysis, Discriminant function analysis.

Note: The emphasis is only on the application of the methods. The derivations of the formulae are not necessary.

Text Books and References

1. S.P. Gupta, Statistical Methods, Sultan Chand & Sons, Pvt. Ltd, New Delhi, 2011.
2. S.C. Gupta, V.K. Kapoor, Fundamentals of Mathematical Statistics, Sultan Chand & Sons, Pvt. Ltd, New Delhi, 2011.
3. Darren George, Paul Mallery, SPSS for Windows, 10th Edition, Pearson, 2011.

NINTH SEMESTER

ICHT 91 - Synthetic Organic Chemistry

Unit - 1 Reagents In Organic Chemistry

Uses of the following reagents in organic synthesis and functional group transformations.

Sodium borohydride, Lithium aluminium hydride, tri-n-butyl tin hydride, Lithium dimethyl cuprate, Lithium diisopropyl amide, Trimethyl silyl iodide, dicyclohexylcarbodiimide, OsO₄, DDQ, SeO₂, PCC.

Phase Transfer Catalysts – Benzyltriethylammonium halides – Crown ethers.

Unit - II Organic Reactions - I

Formation of C-C single bond: Aldol condensation, Claisen ester reaction, Stobbe condensation, Knoevenagel reaction, Michael addition, Dieckmann condensation – Stork enamine reaction – Mannich reaction, Reformatsky reaction

Formation of C=C double bond: Wittig reaction, Perkin reaction, Claisen – Schmidt condensation, Peterson's synthesis.

Unit - III Organic Reactions - II

Cannizzaro and cross Cannizzaro reactions, Benzoin condensation, Wolff-Kishner reduction, Clemmenson reduction, MPV reduction, Birch reduction. Riemer-Tiemann reaction – Gattermann reaction - Chichibabin reaction. Uses of organoboron compounds in organic synthesis. Some industrial applications of organic reactions.

Unit - IV Selective Synthetic Methods

Need for protection of functional groups during chemical reactions – protection of hydroxyl, mercapto, amino, carbonyl and carboxylic groups.

Regioselective synthesis – halogenation of alkanes, ambident nucleophiles, Regiospecific synthesis – reductions using Baker's yeast.

Stereo selective reaction – bromination of dicarboxyacetylene, Sharpless asymmetric epoxidation, synthesis of 2-butanol by using diisopinocampylborane.

Stereospecific reaction – bromination of fumaric and maleic acids.

Unit - V Planning Organic Synthesis

An introduction to retrosynthesis - Synthons, Synthetic equivalent, Target molecule, Functional group interconversion - Disconnection approach – One group disconnection – Disconnection of alcohols, olefins and ketones - Logical and illogical disconnections. Two group disconnection-1,2-, 1,3, 1,4-, 1,5- and 1,6-dioxygenated skeletons and dicarbonyls. Retro Diels – Alder reaction – Pericyclic reactions – Retrosynthesis of some heterocycles containing two nitrogen atoms.

Retrosynthetic analysis of Camphor, Longifiline, Reserpine and Cortisone

Text Book and References

1. R.K. Bansal Organic Reaction Mechanisms, New Age International, 1996.
2. F.A. Carey, R. J. Sunberg, Advanced Organic Chemistry Part A, Springer, 5th edition, 2007
3. W. Carruthers, Some Modern Methods in Organic Synthesis, Cambridge, 1971
4. E.J. Corey, Reactions and Reagents in Organic Synthesis, VCH, 1988
5. C.H. Depuy, O.S. Chapman, Elements of Organic Photochemistry, Prentice Hall, 1975.
6. I.L. Finar, Organic Chemistry Vol.II, ELBS, 1977.
7. R.O.C. Norman, Modern Methods in Organic Synthesis, Macmillan, 1967
8. S.P. Singh, S.M. Mukherjee, Reaction Mechanisms in Organic Chemistry, Macmillan, 1984
9. P. Sykes, Guide Book to Mechanism in Organic Chemistry, Prentice Hall, 6th Edition, 1986.

ICHT 92 - Analytical Techniques

Unit - I Electroanalytical Methods

Principles and application of electrogravimetry, coulometry – amperometry – potentiometry – conductometry – polarography – voltammetry – cyclic voltammetry – anodic stripping voltammetry.

Unit - II Photoelectron And ESR Spectroscopies

Valence and core binding energies – Measurement technique – Koopman's theorem – Chemical shifts in X-ray photoelectron spectroscopy – Auger spectroscopy – Applications of ESCA in chemistry.

Electron spin Resonance Spectroscopy – Origin of the spectrum – method of recording - hyperfine splitting – g value and hyperfine splitting constant - ESR spectra of simple organic radicals - application of ESR spectra to transition metal complexes

Unit - III NQR and Mossbauer Spectroscopies

NQR spectroscopy – Theory of NQR – instrumentation – Nuclear quadrupole coupling constants – Applications.

Mossbauer spectroscopy – principle – source and absorber – isomer shift – quadrupole splitting – magnetic interactions – applications to Fe and Sn compounds.

Unit - IV Diffraction Methods

X-ray diffraction – structures of simple lattices and X-ray intensity – structure factor and its relation to electron density – Identification of unit cells from systematic absence – practical application of single crystal photography – Powder pattern.

Electron and neutron diffractions – scattering intensity vs scattering angle – Wierl equation - scattering of neutrons by solids and liquids – Magnetic scattering – measurement techniques – comparison with X-ray diffraction – Elucidation of structures of simple gas phase molecules.

Unit - V Chromatography and ORD

Principles of gas – liquid and gas – solid chromatography – Instrumentation - Applications – Principles and Applications of HPLC – super critical fluids chromatography – Properties of super critical fluids – Instrumentation and applications.

Theories of optical rotatory dispersion and circular dichroism – correlation between structure and optical rotation – axial haloketone rule – Cotton effect – Octant rule – Deduction of absolute configuration of organic molecules and inorganic complexes.

Text-Books and References

1. R.A.Day, A. L. Underwood, Quantitative Analysis, Prentice Hall, 1999.
2. R.S. Drago, Physical Methods in Chemistry, Saunders, 1999.
3. E.A.V. Ebsworth, D.W.H. Rankine, S.Craddock, Structural Methods in Inorganic Chemistry, ELBS, 1991.
4. J.H.D.Eland, Butterworth, Photoelectron Spectroscopy, 2nd Edition, Elsevier, 1983.
5. E.L. Eliel, Stereochemistry of Carbon Compounds, Tata McGraw Hill, 1962.
6. D.G.Peters, J. M.Hayes, G. M. Hefige, A Brief Introduction to Modern Chemical Analysis, Saunders, 1976.
7. Douglas A. Skoog, F. James Holler, Timothy A. Nieman, Principles of Instrumental Analysis, Saunders Cllee Pub., 1998.
8. H.H. Willard, L.L. Merrit, J.A. Dean, Instrumental Methods of Analysis, W.B. Saunder, 1987.

ICHT 93 - Spectroscopy and Spectrometry

Unit - I UV and IR Spectroscopy

Ultraviolet – Visible spectroscopy – types of electronic transitions – chromophores and auxochromes - factors influencing positions and intensity of absorption bands – absorption spectra of dienes, polyenes and α , β - unsaturated carbonyl compounds – Woodward – Fieser rules.

IR Spectroscopy – vibrational frequencies and factors affecting them – identification of functional groups – intra and inter molecular hydrogen bonding – finger print region – Far IR region – metal ligand stretching vibrations.

Unit - II NMR Spectroscopy

Nuclear spin – magnetic moment of a nucleus – nuclear energy levels in the presence of magnetic field, relative populations of energy levels – macroscopic magnetization – basic principles of NMR experiments – CW and FT NMR – ^1H NMR – chemical shift and coupling constants – factors influencing proton chemical shifts and vicinal proton – proton coupling constants – ^1H NMR spectra of simple organic molecules such as: $\text{CH}_3\text{CH}_2\text{Cl}$, CH_3CHO , etc., AX and AB spin system – spin decoupling – nuclear Overhauser effect – chemical exchange.

Unit - III ^{13}C NMR and Two - Dimensional NMR Spectroscopies

^{13}C NMR – proton decoupled and off-resonance ^{13}C NMR spectra – factors affecting ^{13}C chemical shifts – ^{13}C NMR spectra of simple organic molecules – Basic principles of two-dimensional NMR spectroscopy – HOMOCOSY, NOESY and HSQC spectra and their applications (No pulse sequence is expected).

Unit - IV Mass Spectrometry

Principles – measurement techniques – (EI, CI, FD, FAB, SIMS) – presentation of spectral data – molecular ions – isotope ions – fragment ions of odd and even electron types – rearrangement ions – factors affecting cleavage patterns – simple and multicentre fragmentation – McLafferty rearrangement – Retro Diels–Alder fragmentation. Mass spectra of hydrocarbons, alcohols, phenols, aldehydes, ketones, carboxylic acids, amines and their derivatives.

Unit - V Spectroscopic identification of Organic Compounds

Identification of organic compounds using UV, IR and NMR spectroscopy and mass spectrometry - problems.

Text Books and References

1. D. Dyer, Application of Absorption Spectroscopy of Organic Compounds, Prentice Hall, 1978.
2. V. Fibrolein, Basic and Two Dimensional NMR Spectroscopy, 1982.
3. William Kemp, Organic Spectroscopy, 3rd edition, Macmillan, 1989.
4. J.B. Lambert, H. F. Shurrell, A. P. Lightner, R. G. Cooks, Introduction to Organic Spectroscopy, Macmillan, 1987.
5. Robert M. Silverstein, F. X. Webster, Spectrometric Identification of Organic Compounds, John Wiley, 1998.
6. J.B. Stothers, Carbon -13 NMR Spectroscopy, Academic Press, 1972.

ICHT 94 - Basic Biochemistry

Unit – I

Classification of carbohydrates. Functions of biologically important monosaccharides, disaccharides, homopolysaccharides, and heteropolysaccharides. Carbohydrate metabolism: glycolysis, citric acid cycle, gluconeogenesis, glycogen metabolism (overview only, structures not required). Diabetes mellitus (elementary details).

Unit – II

Amino acids: classification and acid-base properties. Biologically important peptides. Proteins—classification, functions, denaturation and renaturation. Orders of protein structure: Primary, secondary (α -helix, β -pleated sheet), supersecondary, tertiary and quaternary structures. Urea cycle, (overview only, structures not required).

Unit – III

Classification of lipids. Structure and functions of cholesterol. Lipid metabolism: β -oxidation of fatty acids, biosynthesis of fatty acids (overview only, structures not required). Coronary heart disease (elementary details).

Unit – IV

Enzymes: Classification and nomenclature. Specificity, factors affecting enzyme activity- substrate, pH and temperature. Michaelis-Menten equation and L-B plot. Coenzymes and Isoenzymes (brief account only). Allosteric enzymes. Applications of enzymes in clinical diagnosis, therapeutics and industry.

Unit – V

DNA structure- Watson and Crick model. A, B, and Z forms of DNA. DNA denaturation. Differences between DNA and RNA. Major classes of RNA- structure and biological functions.

Text Books

1. D.L.Nelson, M.M.Cox, Lehninger Principles of Biochemistry, Freeman, 6th edition, 2012.
2. R.K. Murray et al., Harper's Illustrated Biochemistry, 30th edition, McGraw Hill, 2015.
3. U. Satyanarayana, Biochemistry, Allied Publishers, latest edition.

ICHT 95 - Soft Skill Development

Unit - 1: Soft Skills and Personality Development

Soft Skills: Meaning and Importance - Hard Skills versus Soft Skills - Self Concept: Self Awareness, Self Development and Self Realisation – Power of Positive Attitude – Etiquette and Manners.

Listening: Types of Listening, Effective Listening and Barriers to Listening – Assertive Communication.

Unit - 2: Communication Skills

Oral Communication: Forms, Types of Speeches and Public Speaking – Presentation: Elements of Effective Presentation and Use of Visual Aids in Presentation.

Written Communication: Strategies of Writing – Business Letters: Form, Structure and Formats – Types of Business Letters – Memos – Agenda and Minutes.

Non-verbal Communication: Body Language and Proxemics.

Unit - 3: Interpersonal Skills

Interpersonal Skills: Relationship Development and Maintenance and Transactional Analysis.

Conflict Resolution Skills: Levels of Conflict and Handling Conflict - Persuasion – Empathy – Managing Emotions – Negotiation: Types, Stages and Skills – Counselling Skills.

Unit - 4: Employability Skills

Goal Setting – Career Planning – Corporate Skills – Group Discussion – Interview Skills – Types of Interview - Email Writing – Job Application – Cover Letter - Resume Preparation.

Unit - 5: Professional Skills

Decision Making Skills – Problem Solving – Emotional Intelligence – Team Building Skills – Team Spirit – Time Management – Stress Management: Resolving Techniques.

References:

1. B.N. Ghosh, *Managing Soft Skills for Personality Development* (Ed). New Delhi, Tata McGraw Hill Education Pvt. Ltd., 2012.
2. Krishna Mohan, Meera Banerji, *Developing Communication Skills*, 2nd Edition, New Delhi MacMillan Publishers India Ltd., 2009.
3. Neera Jain, Shoma Mukherji, *Effective Business Communication*, New Delhi, Tata McGraw Hill Education Pvt. Ltd., 2012.
4. M.S. Rao, *Soft Skills - Enhancing Employability: Connecting Campus with Corporate*, New Delhi, I.K International Publishing House Pvt. Ltd., 2011.
5. M. Ashraf Rizwi, *Effective Technical Communication*,. New Delhi, Tata McGraw Hill Education Pvt. Ltd., 2010.
6. Bretag Tracey, Crossman Joanna, Bordia Sarbari, *Communication Skills*, New Delhi, Tata McGraw Hill Education Pvt. Ltd., 2012.

TENTH SEMESTER

ICHT 101 - Advanced Organic Chemistry

Unit - I Steroids and Hetrocycles

Occurrence- Diel's hydrocarbon - nomenclature and stereochemistry of Steroids.

Sterols: Structural elucidation of cholesterol and cholic acid.

Sex hormones: Estrogens: Structural elucidation and synthesis of estrone, estradiol and estriol.

Gestogens: progesterone – synthesis from cholesterol. Androgens: testosterone and androstrone – Structural elucidation based on their synthesis from cholesterol.

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

Unit - II Modern Synthetic Methods

Catalysed synthetic processes including heterogeneous catalysts, a brief description of phase transfer catalysis, misceller catalysis, organic reactions in organized media, polymer supported reagents and Merrifield synthesis. Electro organic synthesis, microwave assisted organic synthesis and an introduction to sonochemistry .

Unit - III Molecular Rearrangements

Nature of migration, migratory aptitude, memory effects. A detailed study of the following rearrangements: Carbon- carbon migration - Pinacol- Pinacolone, Wagner- Meerwein and Favorskii, Carbon-nitrogen migration - Hoffmann, Schmidt, Lossen, Curtius and Beckmann, Carbon- oxygen migration - Baeyer-Villiger.

Unit - IV Organic Reaction Mechanisms - III

General methods of investigation of organic reaction mechanisms – kinetic and non-kinetic methods- Baldwin rules – cross over experiments – isotopic labeling primary and secondary kinetic isotopic effects – solvent kinetic isotopic effects. S_N1' , S_N2' , S_{Ni} mechanisms - Neighbouring group participation - non-classical carbocation - structure and solvent effect on nucleophilic substitution reactions

Unit - V Advanced Stereochemistry, Antibiotics and Vitamins

Conformation and reactivity in cyclohexane derivatives – conformation analysis of decalines. Secondary structure of peptides.

Antibiotics: classification, structure and uses of penicillins, cephalosporins, chloramphenicol, streptomycin and tetracyclins - Structural elucidation and synthesis of penicillin G and chloroamphenicol.

Vitamins: classification, structure and uses of vitamins A, B₁, B₂, B₆, C, D, E and K Structural elucidation and synthesis of vitamins A, B₁, B₆ and C.

Text Book and References

1. A.Berger, Medicinal Chemistry, Vol.1 & 2, 1st edition, Wiley Interscience, 2003
2. F.A. Carey, R.J. Sundberg, Advanced Organic Chemistry, Section A, 5th edition, Springer, 2007
3. I.L. Finar, Organic Chemistry, Vol. II, ELBS, 1977.
4. W. Carruthers, Some Modern Methods of Organic Synthesis, 4th edition, Cambridge Univ. Press., 2004.
5. H.O. House, Modern Synthetic Reactions, Published by W. A. Benjamin., 1972
6. R.O.C. Norman, Modern Methods in Organic Synthesis, Macmillan, 1967
7. A.R. Pinder, Chemistry of Terpenes, Macmillan, 1962
8. C.W. Shoppee, The Chemistry of Steroids, Published by Butterworth Scientific, New York, 1958.

ICHT 102 - Advanced Physical Chemistry

Unit - I Electrochemistry - IV

Ion-solvent interactions – Born Model, Enthalpy, free energy and entropy of ion-solvent interactions. Primary and secondary solvations (salting in and salting out). Electrode kinetics – Butler Volmer equation, Tafel equation.

Surface electrochemistry. Electrical double layer, Helmholtz-Perrin, Gouy- Chapman, Stern Theories, Lippmann equation.

Unit - II Quantum Chemistry - III

The variation Theorem, linear variation principle, Perturbation Theory (first order and non degenerate). Applications of variation method and perturbation theory to the helium atom. Hybridization-determination of bond angles of sp, sp² and sp³ hybridizations. Huckel pi-electron theory and its applications to ethylene, butadiene and benzene. A brief idea of self consistent fields.

Unit - III Statistical Thermodynamics

Thermodynamic probability and entropy. Maxwell-Boltzmann, Bose-Einstein and Fermi-Dirac statistics.

Partition function – translational, rotational, vibrational and electronic partition functions. Calculations of thermodynamic properties and equilibrium constant in terms of partition functions. Theories of heat capacity of solids.

Unit - IV Chemical Dynamics

Potential energy surfaces - Dynamics of unimolecular reactions – Lindemann-Hinshelwood – Rice Ramsperger Kassel (RRK) theory and Rice Ramsperger Kassel – Marcus (RRKM) theory

Study of fast reactions by laser - flash Photolysis and the nuclear magnetic resonance method.

LFERs – Hammett equation, Taft equation, separation of polar, resonance and steric effects.

Unit - V Surface Chemistry and Macromolecules

Langmuir and BET Isotherms. Adsorption from solutions – Gibbs adsorption isotherm. Study of surface films – surface area determination – Applications of adsorption – adsorption indicators. Surfactant and detergents. Micelle – critical micellar concentrations–applications.

Macromolecules–number average and weight average molecular weights. Determination of molecular weight. Kinetics of polymerizations.

Text books and References:

1. J.O.M. Bockris, A.K.N. Reddy, Electrochemistry, Volumes 1 & 2, Plenum, New York, 1977.
2. W. Levine, Quantum Chemistry, Prentice Hall, 1994.
3. A. K. Chandra, Introduction to Quantum Chemistry, Tata McGraw Hill, 1997
4. R.K. Prasad, Quantum Chemistry, Wiley Eastern, 1993.
5. B.K. Sen, Quantum Chemistry, Tata McGraw Hill, 1992
6. S. Glasstone, An Introduction to Electrochemistry, Affiliated East West Press, New Delhi, 1977.
7. S. Glasstone, Thermodynamics for Chemists, Affiliated East West Press, New Delhi, 1960.
8. J.Rajaram, J.C. Kuriacose, Thermodynamics for Chemistry, Shoban Lal Nagain Chand, New Delhi, 1986.
9. J.I.Steinfield, J.S. Francisco, William L. Hass, Chemical Kinetics and Dynamics, Prentice Hall, New Jersey, 1986.
10. K.J. Laidler, Chemical Kinetics, Tata Mc Graw Hill, 1990.
11. S.H. Maron, C.F. Prutton, Principles of Physical Chemistry, McMillen, 1960.
12. W.J. Moore, Basic Physical Chemistry, Prentice Hall, 1986.

ICHT 103 A - Chemistry of Advanced Materials (Optional III)

Unit - I: Preparative Techniques

Principle of solid state reactions with reference to MgO and Al₂O₃ - Reaction conditions – Structural considerations – reaction rates – Wagner mechanism – nucleation and diffusion – surface structure and reactivity. Synthesis of MgAl₂O₄ (a spinel) – experimental procedure. Synthesis of a Zeolite - (Na_x(AlO₂)_x(SiO₂)_y)mH₂O - Preparation of thin films – chemical vapour deposition – cathode sputtering – Preparation of metastable phase by sol-gel technique – Hydrothermal technique – Zone melting – Melts – vapour phase transport methods – vapour deposition

Unit - II: Phase Transitions

Buerger's classification – Thermodynamic classification - Ubbelohde's classification – Representation of phase transitions on phase diagrams – Kinetics of phase transitions – Nucleation rate – Avrami equation – Factors that affect the kinetics of phase transitions – crystal chemistry and phase transitions – Martensitic transformations – order-disorder transitions

Unit - III: Chemistry of Selective Materials

Glasses – Oxide glasses – bond type – Viscosity - Zachariasen's rules – Sun-Rawson criterion – Chalcogenide glass – the photocopying process – glass ceramics – applications – refractories – applications.

Solid electrolytes: AgI, RhAg₄I₅, β-Alumina – NASICON – Principles and Applications of solid electrolytes

Ferroelectric, piezoelectric and pyroelectric materials – principle, properties and applications. LED – principle – types – advantages and disadvantages of LED displays

Liquid crystal display LCD – properties – twisted nematic field display – Advantages and disadvantages of LCD – comparison of LCD & LED.

Shape Memory alloys (SMA) – classification – working principles. Non- linear optical materials – second harmonic generators

Unit - IV: Characterization of Nanomaterials

Electron microscopies – scanning electron microscopy (SEM), Transmission electron microscopy (TEM), Scanning Transmission Electron Microscopy (STEM), Scanning Probe Microscopy (SPM) – scanning tunneling microscopy (STM) – Atomic manipulations, Focused Ion beam (FIB) technique – Atomic force microscopy (AFM) – scanning probe Lithography (SPL), Dip pen nanolithography (DPN) - Optical microscopies for nanoscience and Technology – Confocal microscopy – scanning near-field optical microscopy – particle size analysis.

Unit - V: Synthesis and Applications of Nanomaterials

Preparation of nanomaterials – plasma arcing, CVD, electrodeposition, sol-gel synthesis, ball milling, use of natural nanoparticles.

Self assembled monolayers – monolayers on gold – preparation – structure – growth process – patterning monolayers – mixed monolayers – Applications – different types of sensors.

Semiconductor quantum dots – synthesis – electronic structure & spectral properties

Monolayer-protected metal nanoparticles – characterization – functionalization – Application - Core-Shell nanoparticles – introduction – types of systems – characterization – properties – Applications

Nanosensors – electrochemical sensors, sensors based on physical properties - nanobiosensors

References

1. Anthony R. West, Solid State Chemistry and its Applications, John Wiley, New Delhi, 2007.
2. M. Arumugam, Materials Science, Anuradha Agencies, Kumbakonam (Chapters V and VI) 2nd Edition, 2003.
3. Douglas A. Skoog, F. James Holler, Timothy A. Nieman, Principles of Instrumental Analysis, Saunders, 1998.
4. T. Pradeep, Nano: The Essentials, Tata McGraw Hill, 2007.
5. Mick Wilson, Kamali Kannangara, Geoff Smith, Michelle Simmons, Burkhard Raguse, Nanotechnology, Overseas Press, 2005.

ICHT 103 B – Advanced Inorganic Chemistry (Optional III)

Unit – I Inorganic Reaction Mechanisms - I

Basic principles – Lability, inertness, stability and instability of coordination compounds – substitution reactions of octahedral complexes – Nature of substitution reactions – Theoretical approach to substitution mechanisms – Mechanism of substitution reaction of complexes of cobalt – acid hydrolysis and base hydrolysis of Co(III) complexes.

Unit - II Inorganic Reaction Mechanisms - II

Substitution reactions of square planar complexes – reaction of Pt(II) complexes – trans effect – theories of trans effect – Mechanism of substitution - kinetics of substitution of Pt(II) complexes.

Electron tunneling hypothesis – Marcus – Hush theory – Atom transfer reaction – one electron and two-electron transfer – Inner sphere and outer sphere mechanisms.

Unit - III Chemistry of Inorganic Materials

Glassy state, glass formers and glass modifiers, applications, ceramic structures, mechanical properties, clay products. Refractories – characterisation properties and applications. Microscopic composites; dispersion strengthened and particle – reinforced, fibre-reinforced composites, macroscopic composites. Nanocrystalline phase, preparation procedures, special properties and applications.

Unit - IV Chemistry of Non-Transition Elements

Peroxo compounds of boron, carbon and sulphur – synthesis, properties and structures of boranes, carboranes, borazines, silicates, silicones - carbides – phosphazenes – sulphur - nitrogen compounds. Interhalogens – pseudohalides and noble gas compounds. Inorganic polymers: Types of inorganic polymers – Metal clusters – Iso and heteropoly acids – polyhalides.

Unit - V Spectral and Magnetic Properties of Complexes

Term state for d ions in Octahedral complexes. Characteristics of d-d transitions. Energy level diagrams of Orgel, Tanabe-Sugano, weak field and strong field concepts. Effect of Jahn Teller distortion, Nephelauxetic effect, Selected examples of d-d spectra – $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$, trans – $[\text{Cr}(\text{en})_2\text{F}_2]^+$, $[\text{Ni}(\text{en})_3]^{2+}$, $[\text{CoF}_6]^{3-}$, $[\text{Co}(\text{ox})_3]^{3-}$, $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$.

Magnetism: dia, para – ferro and antiferro – magnetism – quenching of orbital angular momentum, Temp independent paramagnetism – Effect of spin orbit coupling on spectral and magnetic properties.

Text books and References:

1. D.K. Chakraborty, Solid State Chemistry, New Age International, 2010.
2. H.V. Keer, Principles of the Solid State, Wiley Eastern, 1971.
3. H.J. Emeleus, A.G. Sharp, Modern Inorganic Chemistry, ELBS Publication, 1973.
4. J.E. Huheey, Inorganic Chemistry, Addison Wesley, 1993
5. S.F.A. Kettle, Coordination Compounds, Published by Thomas Nelson, 1969.
6. F.A. Cotton, G. Wilkinson, Advanced Inorganic Chemistry, Wiley Estern, 1988
7. F. Basalo, R.G.Pearson, Mechanism of Inorganaic Reactions, Wiley Estern Publication, 1967
8. M.L. Tobe, Inorganic Reaction Mechanism, Published by Nelson, 1972
9. J.C. Anderson, K.D. Leaver, R.D. Rawlings, J.M. Alexander, Materials Science, 4th Edition, ELBS, Chapman and Hall, 1990.

ICHT 104 A - Applied Chemistry (Optional - IV)

Unit - I: High Polymers

Naturally occurring Polymers— Silk, Wool and collagen

Synthesis, Properties and uses of the following polymers. PE, PP, PVC, PTFE, PMMA, PS, Bakelite, nylons, polyesters, polyamides, polyureas, Synthetic rubbers
Catenanes – 34 Carbon acyloin. Ion Exchange Resins.

Unit - II: Analysis of Water Pollution

Origin of waste water, types, water pollutants and their effects. Sources of water pollution – domestic, industrial, agricultural soil and radioactive wastes as source of pollution, objectives of analysis – parameter for analysis – colour, turbidity, total solids, conductivity, acidity, alkalinity, hardness, chloride, sulphate, fluoride, silica, phosphates and different forms of nitrogen, Heavy metal pollution. Public health significance of cadmium, chromium, copper, lead, zinc, manganese, mercury and arsenic. General survey of instrumental technique for the analysis of heavy metals in aqueous systems. Measurement of DO, BOD and COD. Pesticides as water pollutants and analysis. Water pollution laws and standard.

Unit - III: Applied Photochemistry

Photographic sensitizers – cyanins – pinacyanine, Kryptocyanine – ultraviolet screening agents – Uvinol, Tinuvin – p Fluorescent whitening agent – Blankophor– β calcofluor – SD color photography.

Additive and subtractive processes. Chemistry of color Developers Flash photolysis. Chemistry of vision – organic transistors - Introduction examples, organic light emitting diodes – Applications

Unit - IV: Fuel Analysis and Agricultural Chemistry

Solid, liquid and gaseous fuels – ultimate and proximate analysis – calorific values – grading of coal – Liquid fuels – flash point, aniline point, octane number and carbon residues. Gaseous fuels - producer gas and water gas.

Analysis of soil: moisture, pH, total nitrogen, phosphorous, silica, lime, magnesia, manganese, sulphur and alkali salts.

Fertilizers: Fertilizer industries in India, manufacture of ammonia, ammonium salts, urea, nitrates, phosphates and superphosphates – mixed fertilizers – nitrogen fixation.

Unit - V: Organic Nanomaterials

Fullerenes – synthesis and purification – magnetic and optical properties. Carbon nanotubes – synthesis purification and functionalization.

Nanosensors – nanoscale organisation for sensors – Self-assembly-template method-biological assembling – Lithographic techniques – molecular nanomachines – introduction – single molecular devices.

Text Books and References

1. Stuart Warren, Designing Organic Synthesis, JohnWiley & Sons, 1979
2. John D. Roberts, Marjorie C. Caserio, Basic Principles of Organic Chemistry, 2nd Edition, W. A. Benjamin Inc., 1982
3. Charles H. Depuy, Dennis Chapman, Molecular Reactions and Photochemistry, Prentice Hall, 1985
4. W. Carruthers, Some Modern Methods in Organic Synthesis, Cambridge University Press, 1971
5. Burger's Medicinal Chemistry and Drug Discovery, Vol. I. Edited by Donald J. Abraham, John Wiley & Sons, 2nd edition, 2003.
6. T. Pradeep, Nano: The Essentials", Tata McGraw Hill, 2007.
7. M.L. Jackson, Soil Chemical Analysis, Prentice Hall of India, 1973
8. S.M. Khopkar, Environmental Pollution Analysis, New Age International, 2nd edition, 2011.
9. S.S. Dara, A Text Book of Environmental Chemistry and Pollution Control, S.Chand & Company Ltd., 1993.

ICHT 104 B - Industrial and Medicinal Chemistry (Optional IV)

Unit - I Green Chemistry

Introduction and principle of green chemistry - Environmental friendly green techniques - solvent supported catalysts and reagents, heterogenous reactions, Examples for organic reactions involving green chemistry techniques.

Unit - II Supramolecular Chemistry

Definition of Supramolecular Chemistry, Nature of binding interactions in supramolecular structure: ion-ion, ion-dipole, dipole-dipole, H-bonding, cation-p, anion-p, p-p, and Van der Waals interaction.

Synthesis of crown ethers, cryptands, calixarenes, cyclodextrins, cyclophanes, cryptophanes and dendrimers.

Unit - III Introduction to Computational Chemistry

An introduction to concepts of potential energy surface, Basic principles of molecular mechanics, Basic principles of Ab initio method - Basics principles of Semiempirical calculations (SE) - Basics principles of Density functional theory (DFT). Softwares.

Unit - IV Drug Design

Development of new drugs, Procedures followed in drug design. Structure Activity Relationship (SAR) of morphines and Penicillins. Physico – chemical parameters: Lipophilicity, partition coefficient, electronic ionization constants, Quantitative Structure Activity Relationship. Free – Wilson analysis, Hansch analysis, relationships between – Wilson and Hansch analysis – case study. Concepts of drug receptors. Elementary treatment of Drug receptor interactions.

Unit - V Drug Synthesis

Synthesis of the following drugs

- a. Anxiolytics – Benzodiazepines
- b. Neuroleptics – Phenothiazines
- c. Hypnotics and Sedatives – Piperidinediones
- d. Local anesthetics – Aminobenzoic acid and its derivatives
- e. Anti – coagulants – 1,3 – Indanedione derivatives
- f. Hypoglycemic agents – Sulfonylureas
- g. Antihistaminic agents – Ethylenediamine derivatives
- h. Antimalarials – Aminoquinolines
- i. Analgesics and Antipyretics – Paracetamol, Phenylbutazone.
- j. Anti – inflammatory – Diclofenac

References

1. Rashmi Sanghi, M.M.Srivastava, Green Chemistry: Environment Friendly Alternatives, Narosa Publishers, 2003
2. J.M. Lehn, Supramolecular Chemistry – Concepts & Perspectives, Wiley VCH, 1995
3. P. D. Beer, P.A. Gale, D.K. Smith, Supramolecular Chemistry, Oxford University Press, 1999
4. J.W. Steed, J.L. Atwood, Supramolecular Chemistry, John Wiley Sons, 2000
5. Errol G. Lewars, Computational Chemistry (Introduction to Theory and Applications of Molecular and Quantum Mechanics), Springer, 2003
6. Wilson and Gisvold's Text Book of Organic Medicinal and Pharmaceutical Chemistry, Ed. Robert F. Doerge, 2 011.
7. Graham L. Patrick, An Introduction to Medicinal Chemistry, Oxford, 2009
8. K.Ilango, P.Valentina, Text Book of Medicinal Chemistry, Vol. I, Kreethi Publishers, 2007
9. Ashutosh Kar, Medicinal Chemistry, New Age International Publishers, 2005
10. M.P.S. Ishar, Abdul Faruk, Syntheses of Organic Medicinal Compounds, Narosa Publishing House, 2006
11. Burger's Medicinal Chemistry and Drug Discovery, Vol. I, Ed. by Donald J. Abraham, 6th Edition, John Wiley & Sons, 1994
12. Goodmann and Gilman's Pharmacological Basis of Therapeutics, McGraw Hill, 1941.

ICHP 105 : Practical IX - Organic Chemistry Practical – II

- I. Preparation of Organic compounds involving two stages.
- II. Quantitative analysis and Estimation of phenol, aniline, methyl ketone and glucose by volumetric analysis

ICHP 106 : Practical X - Inorganic Chemistry Practical – II

- I. Quantitative analysis
 - 1) Estimation of Ba²⁺ and Ca²⁺ ions
 - 2) Estimation of Cu²⁺ and Ni²⁺ ions
 - 3) Estimation of Cu²⁺ and Zn²⁺ ions

- 4) Estimation of Cu^{2+} and SO_4^{2-} ions
 - 5) Estimation of Ca^{2+} and Mg^{2+} ions
 - 6) Analysis of pyrolusite
- II Preparation of the following Inorganic complexes
- 1) Tris (thiourea) copper(I) chloride
 - 2) Potassium trioxalatoferrate
 - 3) Tetraammine copper(II) sulphate
 - 4) Microcosmic salt
 - 5) Chrome alum
 - 6) Trans-Diaquadioxalatochromate(III)

ICHP 107 : Practical XI - Physical Chemistry Practical – II

I. Potentiometry

- 1) Single electrode potentials
- 2) Solubility of sparingly soluble salt
- 3) Redox titrations
 - a) Ferrous iron (II) vs dichromate (Fe^{2+} vs $\text{Cr}_2\text{O}_7^{2-}$)
 - b) Iodide ion (I^-) vs KMnO_4
 - c) Ferrous iron (II) vs Cerium (IV) ion (Fe^{2+} vs Ce^{4+})
- 4) Precipitation titrations
 - a) Chloride Vs Silver ion, b) Iodide Vs Silver ion
 - c) Mixture of chloride and iodide ion Vs Silver ion
- 5) Potentiometric titrations (by quinhydrone electrode)
 - a) Strong acid vs Strong base
 - b) Dissociation constant of a weak acid vs NaOH
 - c) Mixture of acids (HCl , CH_3COOH) vs NaOH

II pH Metry

- 1) Dissociation constant of monobasic acid and dibasic acid

III Polarimetry

- 1) Determination of Specific Rotation, 2) Inversion of Sucrose

IV Chemical Kinetics

- 1) Acid catalysed hydrolysis of an ester.
- 2) Comparison of acid strengths.
- 3) Persulphate – iodide kinetics – clock reaction – Primary salt effects
- 4) Influence of Cu^{2+} and Fe^{3+} on the reaction between persulphate and iodide ions.
- 5) Saponification of an ester
- 6) Adsorption of acetic acid/ oxalic acid on charcoal
- 7) Iodination of acetone

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ACHT 01: Allied Chemistry – I

Unit–I : Basic Organic Chemistry

Classification of organic compounds - Hybridization in methane, ethane, acetylene, benzene - Classification of reagents - electrophiles, nucleophiles and free radicals - Classification of reactions - addition, substitution (nucleophilic & electrophilic), elimination, condensation and polymerisation - Polar Effects-Inductive effect, resonance, hyper-conjugation, steric effect.

Unit–II : Chemistry of Some Useful Organic Compounds

Structure and uses of the following:

Paracetamol, Penicillin, Morphine, Camphor, Thiopental Sodium, BHC, DDT, CF_2Cl_2 . Synthesis, properties and uses of, PTFE, PVC, Bakelite, Nylon 6, 6.

Unit–III : Acid-Base Equilibria

Bronsted definition, Lewis definition, K_a , K_b , $\text{p}K_a$ and $\text{p}K_b$ for Bronsted acids and bases. Relative strengths of Bronsted acids and bases. pH Buffer solution. Henderson's equation. Theory of acid-base indicators.

Unit–IV : Coordination Chemistry

Definition of terms-classification of ligands-chelation- Nomenclature of coordination compounds. Effective Atomic Number and its application to $\text{Ni}(\text{CO})_4$, $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{Co}(\text{CN})_6]^{3-}$ Role of metal ions in biological systems such as Hemoglobin, Vitamin B12.

Unit–V : Chemical Kinetics and Photochemistry

Rate of chemical reaction, Differential rate expression, order and molecularity, Integrated rate expressions for first, second, and zero order reactions, Half-life period. Effect of temperature on reaction rate - Activation energy. Arrhenius equation, Catalysis - Homogeneous and heterogeneous catalysis.

Introduction to photochemistry - Grothus - Draper Law, Stark-Einstein's Law. Quantum Yield. Fluorescence, Phosphorescence, Photosensitisation.

Text Books and References

1. V.Veeraiyan, Text book of Ancillary Chemistry, Highmount Publishing House, 2006.
2. J.E.Huheey, Inorganic Chemistry, Addison Wesley, 2005.
3. P.L. Soni and Others, Textbook of Organic chemistry, Sultan Chand and Company, 2006.
4. P.L. Soni and Others, Text book of Inorganic Chemistry, Sultan Chand and Company, 2006.
5. B.R. Puri, L.R. Sharma, S.Pathania, Text book of Physical Chemistry, Vishal Publishing Co., 2006.
6. S.S. Dara, Text book of Environmental chemistry and Pollution Control. S.Chand and Co., 2006.
7. S. Vaithyanathan and Others, Textbook of Ancillary Chemistry, Priya Publications, 2006.

ACHT 02 : Allied Chemistry – II

Unit-I : Chemistry of Natural Products

Terpenoids: Structure and uses – Camphor, vetivones.
Alkaloids – Structure and uses, papavarine, cocaine
Structures and important biological properties

Unit-II : Electrochemistry

Galvanic cells – emf - standard electrode potential - reference electrodes -electrochemical series and its applications-glass electrode and pH determination - Electroplating process -Nickel and Chrome plating - Different types of cells - primary cell, secondary cell. Fuel cells. Corrosion and methods of prevention.

Unit-III : Industrial Chemistry

Production and uses of gaseous fuels like water gas, producer gas, liquefied petroleum gas, gobar gas and compressed natural gas - Fertilizers-manufacture and uses of urea, ammonium sulphate, superphosphate, Hardness of water: temporary and permanent hardness, disadvantages of hard water - Softening of hard water - Zeolite process, Purification of water for domestic use: use of chlorine, Ozone and UV light - Definition and determinations of BOD and COD.

Unit-IV : Analytical Chemistry - I

Introduction to Quantitative Analysis and separation techniques - Principle of volumetric and gravimetric analysis-Estimation of hardness by EDTA method. Estimation of Ni, Ba and Cu by gravimetric methods. Electrogravimetry – theory of electrogravimetric analysis – determination of copper (by constant current procedure) - Separation techniques - extraction - distillation – crystallization.

Unit-V : Analytical Chemistry - II

Colorimetric methods, Beer's law and its validity, estimation of fluoride ion by photocolormeter, flame photometry and atomic absorption spectroscopy- NMR spectroscopy: Nuclear spin and conditions for a molecule to give rise to NMR spectrum – theory of NMR spectra, number of NMR signals, equivalent and non-equivalent protons, position of NMR signals, shielding, de-shielding, chemical shift – δ and τ scales, peak area and number of protons – splitting of NMR signals – spin-spin coupling.

Reference Books

1. V. Veeraiyan, Text book of Ancillary Chemistry, Highmount Publishing House, 2006.
2. S. Vaithyanathan, Textbook of Ancillary Chemistry, Priya Publications, 2006.
3. P. L. Soni, Text book of Organic chemistry, Sultan Chand and Company, 2006.
3. B.R. Puri, L.R. Sharma, S.Pathania, Text book of Physical Chemistry, Vishal Publishing Co., 2006.
5. S.S. Dara. Text book of Environmental Chemistry and Pollution Control, S.Chand and Co., 2006.
6. R.A. Day, A.L. Underwood, Quantitative Analysis, Prentice Hall, 1999.
7. William Kemp, Organic Spectroscopy, 1989.
8. R.M. Silverstein, F.X.Webster, Spectrometric Identification of Organic Compounds, John Wiley, 1998.
9. Jag Mohan, Organic Spectroscopy (Principles & Applications), Narosa Publishing House, 2000.

ACHP 01 : Allied Chemistry Practical – I

Titrimetric Analysis

1. Estimation of sodium hydroxide with standard sodium carbonate using HCl as a link solution
2. Standardization of given sodium hydroxide solution using potassium hydrogenphthalate.
3. Estimation of commercial caustic soda for carbonate and hydroxide content.
4. Titration involving KMnO_4 and standard sodium oxalate.
5. Estimation of Mg^{2+} using EDTA and EBT as indicator.
6. Estimation of Zn^{2+} using EDTA and EBT as indicator.

ACHP 02 : Allied Chemistry Practical – II

Organic Analysis

Detection of Elements (N,S, Halogens)

To distinguish between aliphatic and aromatic Saturated and unsaturated compounds. Functional group tests for phenol, acids (mono, di) aromatic primary amine, amide, aldehyde & Carbohydrate Glucose. Systematic analysis of organic compounds containing one functional group and characterization by confirmatory test.(Phenol/cresol, cinnamic acid, benzoic acid, phthalic acid, Succinic acid, benzamide, urea, glucose, benzaldehyde & aniline).

Reference: Venkateswaran, Veerasamy & Kulandaivel, Basic Principles of Practical Chemistry, S.Chand & Co., 2007.