Dr. AMBEDKAR GOVERNMENT ARTS COLLEGE (AUTONOMOUS)
CHENNAI – 600039.

DEPARTMENT OF CHEMISTRY

Date : 12. 06.2019, Wednesday **Time** : 10.00 a.m.

AGENDA – B.Sc. CHEMISTRY

- To discuss the course content of the existing syllabus
- To suggest suitable modifications and
- To consider and approve the modified syllabus

C. Srinivasan 12/6/19
Chairman

University Nominee	- Mr.A.Gopalakrishnan	-
Subject Expert 1	- Dr.V.Sivamurugan	-
Subject Expert 2	- Dr.S.Balasubramanian	- 12.6.19
Industrial Nominee	- Mr.G.Chandrasekar	-
Alumni	- Mr.R.Giridharan	-
Dept Staff Members	- Dr.R.Ravichandran	-
	- Dr R.Karthikeyan	- 12/6/19
	- Dr.S.Manivannan	- 12/6/19.
	- Mr.K.Chandrasekaran	- 12/6/19
	- Mrs.T.Gayathri	- 12/6
	- Dr.P.Krishnamurthy	- 12/6/19
	- Mrs.S.Ananthi	- 12/6/19
	- Dr.T.K.Arumugam	- 12/6/19
	- Mrs.RevathySelvaraj	- 12/6/19
	- Dr.G.Ramesh	- 12/06/19
	- Dr.G.Ramachandran	- 12.6.19
	- Dr.S.Shanmugasundari	- 12/6/19
	- Dr.S.Vidya	- 12/6/19
	- Dr.L.Lakshmi	- 12/6/2019

Dr.AMBEDKAR GOVERNMENT ARTS COLLEGE (AUTONOMOUS)
CHENNAI – 600039.

DEPARTMENT OF CHEMISTRY

Minutes of the Meeting of Board of Studies in B.Sc., CHEMISTRY

Date : 12. 06.2019, Wednesday **Time** : 10.00 a.m.

- The Curriculum was revised based guidelines laid down by Tamilnadu State Council for Higher Education (TANSCHE)

- The members of the Board discussed the course content in details and incorporated necessary changes.

The following resolutions were adopted in the meeting

RESOLVED that the draft syllabi proposed for B.Sc., Chemistry by the Department of Chemistry were discussed and approved with the following changes and decided to implement the same for the students admitted from the academic year 2019-2020.

- Environmental studies subject shifted from **IV** to **III** semester
- Value based education subject shifted from **V** to **IV** semester
- Volumetric analysis lab is retained in I year and Qualitative analysis lab retained in II year.
- Based on the importance of Organic analysis lab, it is recommended to retain the same in III-year course of study.
- Practical Examinations are to be conducted at the end of Even semester as per the regulations of University of Madras.
- For Elective subjects Analytical Chemistry, Pharmaceutical Chemistry and Agricultural Chemistry new topics were introduced.

C. Srinivasan
12/6/19
CHAIRMAN

Dr. AMBEDKAR GOVERNMENT ARTS COLLEGE (AUTONOMOUS)
CHENNAI – 600039.

DEPARTMENT OF CHEMISTRY

Minutes of the Meeting of Board of Studies in B.Sc., CHEMISTRY

Date : 12. 06.2019, Wednesday **Time** : 10.00 a.m.

MEMBERS PRESENT

S.No	NAME	DESIGNATION	MEMBERSHIP	SIGNATURE
1	**Dr.C.Srinivasan**	Assistant Professor of Chemistry and Head i/c	CHAIRMAN	C. Srinivasan 12/6/19
2	**Mr.A.Gopalakrishnan**	Assistant Professor of Chemistry, D.G Vaishnav College, Arumbakkam, Chennai-106.	UNIVERSITY NOMINEE	
3	**Dr.V.Sivamurugan**	Assistant Professor of Chemistry Pachaiappa's College, Chennai-600 030	SUBJECT EXPERT -1	
4	**Dr.S.Balasubramanian**	Assistant Professor of Chemistry Presidency College,Chennai-600 005	SUBJECT EXPERT -2	12.06.19
5	**Mr.G.Chandrasekar**	General Manager, R & D / QA Raj Petro Specialties PvtLimited Manali,Chennai.	INDUSTRY NOMINEE	
6	**Mr.R.Giridharan**	B.Sc. Chemistry (2009-2012 Batch) .	ALUMNI	
FACULTY MEMBERS OF THE CHEMISTRY DEPARTMENT				
7	**Dr.R.Ravichandran**	Assistant Professor	MEMBER	
8	**Dr. R.Karthikeyan**	Assistant Professor	MEMBER	12/6/19

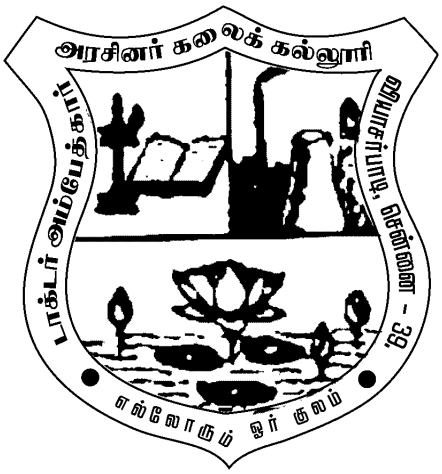
9	**Dr.S.Manivannan**	Assistant Professor	MEMBER	12/6/19.
10	**Mr.K.Chandrasekaran**	Assistant Professor	MEMBER	12/6/19
11	**Mrs.T.Gayathri**	Assistant Professor	MEMBER	12/6
12	**Dr.P.Krishnamoorthy**	Assistant Professor	MEMBER	12/6/19
13	**Mrs.S.Ananthi**	Assistant Professor	MEMBER	12/6/19
14	**Dr.T.K.Arumugam**	Assistant Professor	MEMBER	12/6/19
15	**Mrs.RevathySelvaraj**	Assistant Professor	MEMBER	12/6/19
16	**Dr.G.Ramesh**	Assistant Professor	MEMBER	12/06/19
17	**Dr.G.Ramachandran**	Assistant Professor	MEMBER	12/6/19.
18	**Dr.S.Shanmugasundari**	Assistant Professor	MEMBER	12/6/19
19	**Dr.S.Vidya**	Assistant Professor	MEMBER	12/6/19
20	**Dr.L.Lakshmi**	Assistant Professor	MEMBER	12/06/2019

DR.AMBEDKAR GOVERNMENT ARTS COLLEGE

(AUTONOMOUS)

VYASARPADI, CHENNAI – 600 039.

Accredited by NAAC at level B



Syllabus for B.Sc. Chemistry
Under CBCS
(Under Semester system with credits)
Effective from the academic year 2019-2020

POST GRADUATE AND RESEARCH DEPARTMENT OF CHEMISTRY

Preamble*

In keeping with the announcement of the Honorable Minister for Higher Education (Policy Note 6.3 2013-2014, *Department of Higher Education, Government of Tamil Nadu*), with the view to provide compatibility in courses offered by various universities, autonomous colleges & deemed universities in Tamil Nadu facilitating the mobility of faculty and students from one university to another and to easily solving the problem of equivalence among courses, *Tamil Nadu State Council for Higher Education (TANSCHE)* has formed the *State Integrated Boards of Studies* comprising experts in the areas of knowledge concerned. The *State Integrated Boards of Studies,* with great diligence and expertise has devised the mandatory areas that have to be covered for three year undergraduation and two year postgraduation courses to realize the above objectives. Great care has been taken so that these areas would take 75% of the course content and the remaining 25% can be decided by the individual institutions.

In other words, the areas that have to be covered by the student that are mandatory for earning the degree to have due value has been worked out so that the student will gain enough depth of knowledge in the subject concerned. It is recommended that the institutions specify in their brochures if the course is equivalent or not so that the stakeholder could opt for the course offered with enough awareness about the future possibilities of deciding on the course. The *State Integrated Boards of Studies*[1] have striven their best to see that the standards of higher education in our State are raised to be on a par with international standards.

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[1] ***Note: It is stated that it is not a compulsion on the part of any educational institution in the State to follow *State Integrated Board of Studies*. However, if the subjects are to be equivalent, Section 'A' must be covered in the 75% of the syllabus of the subjects concerned.**

Section A (Mandatory Areas) of each course is mandatory and the areas given must be covered in the 75% of the syllabus to make the course equivalent. 25% percent of the syllabus should be designed by the institutions, and the areas covered under this also must have a weightage of 25%. Possible areas for this 25% are suggested in Section B (Suggested Non mandatory Areas). This gives the individual universities and autonomous institutions seamless liberty to innovate and experiment, and more importantly, it is here that the institutions must devise appropriate strategies by which (i) to make creative and critical applications of what has been learnt in the mandatory components, and (ii) to meaningfully connect the learners to the career demands and expectations. It is essential that the theoretical subject knowledge of the students must be translated into practical hands-on experience.

COURSE OF STUDY:

The main Subject of Study for Bachelor Degree Courses shall consist of the following.

PART – I TAMIL / OTHER LANGUAGES

PART – II ENGLISH

PART – III CORE SUBJECTS

ALLIED SUBJECTS

ELECTIVES WITH THREE COURSES

PART – IV

1. NON MAJOR ELECTIVE
2. SKILL BASED SUBJECTS (ELECTIVE) - (SOFT SKILLS)
3. ENVIRONMENTAL STUDIES
4 VALUE EDUCATION

PART – V EXTENSION ACTIVITIES

Choice Based Credit System

The minimum Credit requirement for a three year UG course shall be 140. (60 credits for Core,15 credits for Elective, 24 credits for languages 20 credits for Allied subjects and 21 credits for Soft skill papers,NME,EVS VE and extension activity).

REGULATIONS

(Effective from the academic year 2019-2020 and thereafter)

1. ELIGIBILITY FOR THE AWARD OF DEGREE

A candidate shall be eligible for the award of the degree only if he/she has

undergone the prescribed course of study in a college affiliated to the University for a period of not less than three academic years, passed the examination of all the six semester prescribed earning minimum of 140 credits and fulfilled such conditions as have been prescribed therefore.

2. DURATION OF THE COURSE

The duration of the course is for three academic years consisting of six Semesters.

3. EXAMINATIONS

There shall be six semester examinations: first semester examinations at the middle of the first academic year and the second semester examination at the end of the first academic year. Similarly, the third, fourth,fifth and sixth semester examinations shall be held at the middle and the end of the second academic year , respectively.

4. COURSE OF STUDY AND SCHEME OF EXAMINATIONS

The scheme of examinations for different semesters shall be as follows:

FIRST SEMESTER

Name of the course	Sub code	Inst. hours	Credits	CIA	Ext	Max. Marks
Tamil Paper I	19UAFTA1	6	3	25	75	100
English paper I	19UAFEN1	4	3	25	75	100
Core Paper I General Chemistry I	19UACHC1	6	4	25	75	100
Core Paper II Volumetric Analysis Practical		3	-	Examination will be conducted in the even semester		
Allied paper I Allied Maths– I/Allied Zoology - I	19UAMAA1 19UAAZA1	7/4	5/4	25	75	100
Allied Zoology Practical		3	-	Examination will be conducted in the even semester		
NME I - Chemistry in everyday life	19UACHN1	2	2	25	75	100
SS1	19UASBE1	2	3	40	60	100
Tamil Paper I	19UAFTA1	6	3	25	75	100
		30				

SECOND SEMESTER

Name of the course	Sub code	Inst. hours	Credits	CIA	Ext	Max. Marks
Tamil Paper II	19UBFTA2	6	3	25	75	100
English paper II	19UBFEN2	4	3	25	75	100
Core Paper III General Chemistry II	19UBCHC1	6	4	25	75	100
Core Paper II Volumetric Analysis Practical	19UBCHC2	3	4	40	60	100
Allied paper II Allied Maths – II / Allied Zoology - II	19UBMAA2 19UBAZA2	4	5/4	25	75	100
Allied Zoology Practical	19UBAZA3	3	2	40	60	100
NME II- Industrial Chemistry	19UBCHN2	2	2	25	75	100
SS2	19UBSBE2	2	3	40	60	100
		30				

THIRD SEMESTER

Name of the course	Sub code	Inst. hours	Credits	CIA	Ext	Max. Marks
Tamil Paper IV	19UDFTA4	6	3	25	75	100
English paper IV	19UDFEN4	4	3	25	75	100
Core Paper V General Chemistry IV	19UDCHC1	6	4	25	75	100
Core Paper VI Inorganic Qualitative Analysis	19UDCHC2	3	4	40		
Allied paper IV Allied Physics- II	19UDPHA2	4	4	25	75	100
Allied Physics Practical	19UDPHA3	3	2	40		
Value Education	19UDVBE1	2	2	25	75	100
SS 4 Computer basics & Automation	19UDSBE4	2	3	25	75	100
Extension activity	19UDEXT1	-	1			
	Total	30	24			

FOURTH SEMESTER

Name of the course	Sub code	Inst. hours	Credits	CIA	Ext	Max. Marks
Tamil Paper IV		6	3	25	75	100
English paper IV		4	3	25	75	100
Core Paper VI General Chemistry IV		6	4	25	75	100
Core Paper VII Inorganic Qualitative Analysis		3	4	40	60	100
Allied paper IV Physics		4	4	25	75	100
Allied Physics Practical		3	4	40	60	100
Value Education		2	2	25	75	100
Computer basics & Automation		2	3	40	60	100
Extention activity		-	1			
	Total	30	28			

FIFTH SEMESTER

Name of the course	Sub code	Inst. hours	Credits	CIA	Ext	Max. Marks
Core Paper VII Organic Chemistry I	19UECHC1	6	4	25	75	100
Core paper VIII Inorganic Chemistry I	19UECHC2	6	4	25	75	100
Core Paper IX Physical Chemistry I	19UECHC3	6	4	25	75	100
Core Paper XIII Physical Chemistry Practical		3	-	Examination will be conducted in the even semester		
Core Paper XIV Gravimetric Estimation Practical		4	-	Examination will be conducted in the even semester		
Elective II Pharmaceutical Chemistry	19UECHE1	5	5	25	75	100
	Total	30	17			

SIXTH SEMESTER

Name of the course	Sub code	Inst. hours	Credits	CIA	Ext	Max. Marks
Core Paper X Organic Chemistry II	19UFCHC1	5	4	25	75	100
Core paper XI Inorganic Chemistry II	19UFCHC2	5	4	25	75	100
Core Paper XII Physical Chemistry II	19UFCHC3	5	4	25	75	100
Core Paper XIII Physical Chemistry Practical	19UFCHC4	3	4	40	60	100
Core Paper XIV Gravimetric Estimation Practical	19UFCHC5	4	4	40	60	100
Core Paper XV Organic Analysis Practical	19UFCHC6	3	4	40	60	100
Elective III Analytical Chemistry	19UFCHE1	5	5	25	75	100
	Total	30	25			

Practical Examinations shall be conducted at the end of even semester.

The following procedure to be followed for Internal marks:

Theory: Internal Marks: 25. The break up for continuous Assessment is as follows.

a) Test (2 x 20) : 40 Marks
b) Assignment (2 x 10): 20 Marks
c) Model Examination (1 x 40): 40 Marks

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100 Marks

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100 Marks for continuous assessment can be converted to 25 Marks

Practical: Internal Marks: 40

Model Examination	20 marks
Test (Best two out of three)	30 marks
Record and Observation	50 marks
	---
	100 marks
	---

100 Marks for continuous assessment can be converted to 40 Marks

5. REQUIREMENT FOR PROCEEDING TO SUBSEQUENT SEMESTERS

(i) Candidates shall register their names for the First semester examination after the admission in the UG courses.

(ii) Candidates shall be permitted to proceed from the First Semester upto the Final Semester irrespective of their failure in any of the Semester Examination subject to the condition that the candidates should register for all arrear subjects of earlier semester along with current (subject) Semester subjects.

(iii) Candidates shall be eligible to proceed to the subsequent semester, only if they earn, sufficient attendance as prescribed therefore by the Syndicate from time to time.

Provided in case of candidate earning less than 50% of attendance in any one of the semester due to any extraordinary circumstance such as medical grounds, such candidates who shall produce Medical Certificate issued by the Authorised Medical Attendant (AMA), duly certified by the Principal of the College, shall be permitted to proceed to the next semester and to complete the course of study. Such candidate shall have to repeat the missed semester by rejoining after completion of final semester of the course, after paying the fee for the break of study as prescribed by the University from time to time.

6. PASSING MINIMUM

a) There shall be no Passing Minimum for Internal.

b) For External Examination, Passing Minimum shall be of 40% (Forty Percentage) of the maximum marks prescribed for the paper.

c) In the aggregate (External + Internal) the passing minimum shall be of 40% for each Paper/Practical.

d) Grading shall be based on overall marks obtained (internal + external).

7. CLASSIFICATION OF SUCCESSFUL CANDIDATES

Candidates who secured not less than 60% of aggregate marks (Internal + External) in the whole examination shall be declared to have passed the examination in the First Class.

All other successful candidates shall be declared to have passed in Second Class.

Candidates who obtain 75% of the marks in the aggregate (Internal + External) shall be deemed to have passed the examination in First Class With Distinction, provided they pass all the examinations (theory papers, practicals,) prescribed for the course in the First appearance.

8. GRADING SYSTEM

1. **Passing minimum** is 40% of the ESE and also 40% of the maximum of that paper/Course.
2. **Minimum Credits to be earned**: Best 140 Credits (Three year Programme)
3. **Marks and Grades**:

The following table gives the marks, grade points, letter grades and classification to indicate the performance of the candidate.

Conversion of Marks to Grade points and Letter Grade

(Performance in a Paper/Course)

RANGE OF MARKS	GRADE POINTS	LETTER GRADE	DESCRIPTION
90-100	9.0 – 10.0	O	Outstanding
80-89	8.0 – 8.9	D+	Excellent
75-79	7.5 – 7.9	D	Distinction
70-74	7.0 – 7.4	A+	Very Good
60-69	6.0 – 6.9	A	Good
50-59	5.0 – 5.9	B	Average
00-49	0.0	U	Re-appear
ABSENT	0.0	AAA	ABSENT

Ci = Credits earned for course i in any semester.

Gi = Grade point obtained for course i in any semester

'n' refers to the semester in which such courses were credited.

For a Semester:

GRADE POINT AVERAGE[GPA] = $\sum i\ Ci\ Gi / \sum i\ Ci$

GPA= Sum of the multiplication of Grade points by the credits of the courses

Sub of the credits of the courses in a semester

For the entire programme:

CUMULATIVE GRADE POINT AVERAGE[CGPA] = $\sum n \sum i\ CniGni / \sum n \sum i\ Cni$

CGPA = Sum of the multiplication of grade points by the credits of the entire programme

Sum of the credits of the courses of the entire programme

CGPA	GRADE	CLASSIFICATION OF FINAL

		RESULT
9.5 – 10.0	O^+	First Class – Exemplary*
9.0 and above but below 9.5	O	
8.5 and above but below 9.0	D^{++}	First Class with Distinction
8.0 and above but below 8.5	D^+	
7.5 and above but below 8.0	D	
7.0 and above but below 7.5	A^{++}	First Class
6.5 and above but below 7.0	A^+	
6.0 and above but below 6.5	A	
5.5 and above but below 6.0	B^+	Second Class
5.0 and above but below 5.5	B	
0.0 and above but below 5.0	U	Re-appear

* The candidates who have passed in the first appearance and within the prescribed semester of the UG programme. are eligible.

9. RANKING

Candidates who pass all the examinations prescribed for the course in the **first appearance itself alone** are eligible for Ranking/Distinction.

Provided in the case of candidates who pass all the examinations prescribed for the course with a break in the First Appearance due to the reasons as furnished in the Regulations under "Requirements for Proceeding to subsequent Semester" are only eligible for Classification.

10. PATTERN OF QUESTION PAPER:

PART-A (50 words): Answer 10 out of 12 Questions 10 x 2 = 20 marks

PART-B (200 words): Answer 5 out of 8 Questions 5 x 5= 25 marks

PART-C (500 words): Answer 3 out of 5 Questions 10 x 30 = 30 marks

Semester I

CORE PAPER I

GENERAL CHEMISTRY I

Unit-I: Classification and Nomenclature

Objectives: *To understand and gain the basic knowledge on the classification and IUPAC nomenclature of organic compounds.*

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

Outcome: *Students learn about organic compound with various functional groups and naming of organic compounds.*

Unit-II: Bonding in Organic Molecules

Objectives: *To study about (i) hybridization and geometry of organic molecule and (ii) Electronic effects, bonding and its influences.*

Hybridization and geometry - bond angle, bond length, bond strength of C-H and C-C bonds - Van der Waal's interactions, Inter & Intra molecular forces and their effects on physical properties - Electronic effects - inductive effect, resonance effect - drawing of resonance structures - conditions for resonance - stability of resonance structures, hyper conjugation, electromeric effect, steric effect - steric overcrowding - steric inhibition of resonance - steric relief (with examples). Dissociation of bonds - homolysis and heterolysis - radicals, carbocations, carbanions - electrophiles and nucleophiles - Influence of electronic effects - dipole moment - relative strengths of acids and bases - stability of olefins - stability of radicals, carbocations and carbanions.

Outcome: *Students can gain the knowledge on hybridization and geometry of organic molecule and Electronic effects, bonding and its influences on organic molecules.*

UNIT-III: Chemical bonding

Objectives: *i) To understand the nature of covalent and ionic bonds ii) To understand the principles and theories of chemical bonding iii) To learn the hybridization and shapes of simple inorganic molecules*

Ionic bond – Properties of ionic compounds, factors favoring the ionic compounds ionization potential – electron affinity – electronegativity – Lattice energy – Born-Haber Cycle – Pauling and Mulliken's scales of electronegativity – Polarizing power and Polarizability – Partial ionic character from electronegativity. Transition from ionic to covalent character and vice versa – Covalent character of ionic compounds – Fajan's rules – Covalent bond – structure and bonding of homo and heteronuclear molecules – Hydrogen bonding – Its nature, types, effect on properties – Intermolecular forces – London forces and van der Waals forces – ion dipole-dipole interactions. VSEPR Theory – Principles and hybridization- Shapes of simple inorganic molecules ($BeCl_2$, BF_3, $SiCl_4$, PCl_5, SF_6, IF_7,H_2O, NH_3, XeF_6) – MO Theory –Bonding and anti-bonding orbitals – Applications of MO theory H_2, He, N_2, O_2, HF and CO molecules – Comparison of VB and MO Theories.

Outcome: *i) Students gain knowledge about the common themes running through ionic and covalent chemical bonding. ii) Get idea behind the structure and bond type of simple inorganic molecules.*

UNIT – IV: Periodic properties

Objectives: *i) To learn the shape of atomic orbitals and various type of quantum numbers ii) To learn the periodic properties of elements and its classifications*

Atomic orbitals - Quantum numbers- Principal, Azimuthal, Magnetic and Spin quantum numbers and their significance - principles governing the occupancy of electrons in various quantum levels- Pauli's exclusion principle – Hund's rule- Aufbau Principle, (n+1) rule- Stability of half-filled and completely filled orbitals- inert pair effect.

Periodic properties – classification of elements as s, p, d and f-block elements – variation of atomic volume – atomic and ionic radii – ionization potential – electron affinity and electro

negativity along period and groups – variation of metallic characters - Factors affecting the periodic properties. Periodic table anomalies and variations in atomic radius, ionic radius, electronic configuration, , electron affinity and electro negativity, ionization energy and metallic character of elements along the group and periods and their influences on stability, colour, coordination number, geometry, physical and chemical properties.

Outcome: i) *Gain knowledge about various quantum numbers and occupancy of electrons on various quantum levels ii) Understand how the concept of electro negativity and its variation over the periodic table can be used to rationalize the nature of the bonding in substances.*

Unit – V: Atomic Structure

Objectives: *i) To learn the various atomic models ii) To understand the quantum theory and wave mechanical concept iii) To learn the shapes of orbitals*

Planck's quantum theory - Photoelectric effect, Compton effect, Bohr's model of hydrogen atom (no derivation), Wave particle duality, de Broglie equation, Heisenberg uncertainty principle - Eigen function and Eigen value - Postulates of Quantum mechanics - Schrodinger's time independent wave equation (no derivation), wave functions and its physical properties - Normalization and Orthogonal function.

Outcome*: Students can gain knowledge about atomic models and basic concept of Quantum theory.*

Reference Books:

1. R. T. Morrison, R. N. Boyd and S.K.Bhattacharjee, Organic chemistry, 7thedn, Pearson Education Asia, 2010.
2.. Arun Bahl and B.S. Bahl, A Text Book of Organic Chemistry, 22ndedn, S Chand & Company, 2016.
3. I. L. Finar, Organic Chemistry Vol-1& 2, 6thedn, Pearson Education Asia, 2004.
   R. D. Madan, Modern Inorganic Chemistry, 3rdedn, S. Chand & Company Ltd., Reprint 2014.
4. P.L. Soni, Text book of Ionrganic Chemistry, 20thedn, Sultan chand& Sons, 2000.
5. B.R.Puri, L.R.Sharma and M.S.Pathania, Principles of Physical hemistry.47thedn, Vishal Publishing Co., 2017.

ALLIED CHEMISTRY – I

(Common to all Branches)

Unit I: NUCLEAR CHEMISTRY

Fundamental particles Of Nucleus - Isotopes, Isobars, Isotones and Isomers -Differences between chemical reactions and nuclear reactions - Fusion and fission - Radio active series, group displacement law - Mass defect - Applications of radio isotopes - carbon dating, rock dating and medicinal applications.

Unit II: INDUSTRIAL CHEMISTRY

Fuels- Classification-gaseous fuels like water gas, producer gas, liquefied petroleum gas, gobar gas, Compressed natural gas - Fertilizers- Classification - urea, Ammonium sulphate, superphosphate, Triple super phosphate, potassium nitrate- manufacture and uses- Hardness of water: temporary and permanent hardness, disadvantages of hard water - Softening of hard water - demineralization process and reverse osmosis - Purification of water for domestic use.

UNIT III: FUNDAMENTALS OF ORGANIC CHEMISTRY

Classification of organic compounds - Classification of reagents - electrophiles, nucleophiles and free radicals - Classification of reactions - addition, substitution, elimination, condensation and polymerisation - Polar Effects-Inductive effect, resonance, hyper-conjugation, steric effect - Keto-enol tautomerism - electrophilic substitution mechanism in benzene (Nitration and Sulphonation)

UNIT IV: CHEMISTRY OF SOME USEFUL ORGANIC COMPOUNDS

Preparation and uses of CH_2Cl_2, $CHCl_3$, CCl_4, CF_2Cl_2. BHC, DDT and Teflon - Heterocyclic compounds - Preparation, properties and uses of furan, thiophene, pyrrole, pyridine.

Unit V : PHOTOCHEMISTRY

Introduction to Photochemistry - statement of Grothus - Draper Law, Stark- Einstein's Law, Quantum yield. 'Hydrogen-Chlorine reaction, Photosynthesis, photosensitization, phosphorescence, Fluoresence and Chemiluminiscence - Definition with examples.

TEXT BOOKS

1. Dr .Veeraiyan V., Text book of Ancillary Chemistry, Highmount Publishing house, Chennai-14. Edition-2006.
2. Soni P.L. and Others, Textbook of Organic chemistry, Sultan Chand and Company, New Delhi, Edition-2006.
3. Puri B.R., Sharma and Pathania, Text book of Physical Chemistry, Vishal Publishing Co., New Delhi. Edition-2006.

NON MAJOR ELECTIVE I

CHEMISTRY IN EVERY DAY LIFE

UNIT I – MEDICINAL CHEMISTRY

Aneasthetics-Antipyretics- Analgesics-Antiseptic- Antimalarial- Antibiotics-Antacids-Definition, Examples,uses and their side effects.

UNIT II – DYES

Definition- Characteristics- Classification- Examples. Application of dyes- Environmental impact- removal of effluents from dye industry.

UNIT- III CHEMICALS IN FOOD

Food preservatives- Table salt,Vegetable oils and Sodium benzoate-Artificial sweetening agents-Saccharin,Sucralose,Aspartame (only structure)-Antioxidants- Definition and examples.

UNIT-IV POLYMERS

Cellulose,Starch,Wool and Silk- Polythene,Natural and Synthetic rubbers-Buna rubbers and their uses-Polyesters-Nylon-6,6-Formaldehyde resins- biodegradable plastics- .

UNIT-V CLEANSING AGENTS

Soaps-Manufacture – Synthetic Detergents –Examples-Cleansing action.

REFERENCES:

1. Engineering Chemistry by P.C. Jain and Monica Jain, Dhanpatrai and Sons, 15th edition, 2006.
2. Thanlamma Jacob, Text Book of Applied Chemistry for Home Science and Allied Science, Macmillan.
3. Swaminathan. M, Food Science and Experimental foods, Ganesh and Company.

Core Paper-II
VOLUMETRIC ANALYSIS

EXPERIMENTS IN VOLUMETRIC ANALYSIS:

1. Estimation of hydrochloric acid using standard oxalic acid.
2. Estimation of sodium hydroxide using standard Na_2CO_3 .
3. Estimation of Ferrous sulphate using ferrous ammonium sulphate.
4. Estimation of oxalic acid using standard ferrous sulphate.
5. Estimation of Ferrous iron using diphenyl amine as internal indicator.
6. Estimation of Potassium Permanganate using standard ferrous sulphate
7. Estimation of Magnesium using EDTA.
8. Estimation of hardness of water using standard EDTA

REFERENCEBOOK:

Sundaram, Krishnan , Raghavan, Practical Chemistry (Part II) ,S.Viswanathan Co. Pvt.Ltd. 1996.

SEMESTER II

CORE PAPER III

GENERAL CHEMISTRY II

UNIT – I: Aliphatic Compounds

Objectives: *To learn the preparation, properties and importance of aliphatic hydrocarbons.*

Alkanes - preparations, physical properties, reactions, reactions with radical mechanism for substitution reaction - cracking - Alkenes: Preparation from alcohol, haloalkane, dihaloalkanes and alkynes - reactions of alkenes - mechanisms involved in addition of hydrogen, halogen, hydrogen halide, hypohalous acid, water, hydroboration, hydroxylation, ozonolysis and epoxidation - peroxide effect - allylic substitution, oxidation by $KMnO_4$ and polymerization - Application in the synthesis of following molecules - Dibenzyl (from toluene), cis and trans 2-butene, propanal and 1-methyl cyclohexanol. Akynes: preparation, reactions - addition of hydrogen, halogen, hydrogen halide, water, HCN, CH_3COOH, hydroboration - dimerisation and cyclisation - acidity of terminal alkynes.

Outcome: *Students gain knowledge on the preparation, properties and reactions of aliphatic compounds.*

UNIT – II: Alicyclic Compounds

Objectives: *To study t the synthesis, reactions, stability and significance of alicyclic compounds.*
Cycloalkanes: Preparation (small, medium & large ring compounds) - reactions - cycloaddition, dehalogenation, pyrolysis of calcium salt of dicarboxylic acid - Wurtz reaction - stability of cycloalkanes - Baeyer's strain theory. Cycloalkenes: Preparation and reactions of cycloalkenes - Preparation of conjugate dienes - reactions - 1,2 and 1,4 addition, polymerization and Diels-Alder reaction - Application in the synthesis of following molecules - trans 2-chlorocyclopentanol, trans-2 methylcyclopentanol, cis and trans 1,2 cyclohexanediol, cyclohexene, 2,3-butanedione and adipic acid.

Outcome: *Students can get knowledge of synthesis, reactions, and importance of alicyclic compounds.*

UNIT - III.1: s - block elements

Objectives: *To understand the chemistry of s - block elements and its complexes.*

Position of hydrogen in the periodic table, General characteristics of s – block elements – Compounds of s-block metals – oxides, hydroxides, peroxides, superoxide's-preparation and properties – oxo salts – carbonates – bicarbonates – nitrates – halides and polyhalides. Anomalous behavior of Li and Be – extraction of beryllium – physical and chemical properties of Be – Uses – Extraction of Mg – physical and chemical properties – Uses. Complexes of s-block metals – complexes with crown ethers – biological importance sodium and potassium – Organometallic compounds of Li and Be.

Outcome: *Get knowledge about compounds and biological importance of some s block elements*

UNIT - III.2: Principles of Volumetric Analysis

Objectives: *To enable the students to acquire knowledge in the theory behind the volumetric analysis, this leads them to develop the knowledge in the principles of concentration, primary and secondary standards.*

General principle: Types of titrations. Requirements for titrimetric analysis. Concentration systems: Molarity, molality formality, normality, wt%, ppm, milli equivalence and millimoles - problems. Primary and secondary standards, criteria for primary standards, preparation of standard solutions, standardization of solutions. Limitation of volumetric analysis, endpoint and equivalence point. Neutralisation-titration curve, theory of indicators, choice of indicators. Use of phenolphthalein and methyl orange. Complexometric titrations: Stability of complexes, titration involving EDTA. Metal ion indicators and characteristics. Problems based on titrimetric analysis.

Outcome: *They know the theory behind the volumetric analysis, which gives the information about the concentration, and Primary & Secondary standards.*

UNIT- IV: Metallurgy

Objectives: *To know about basic metallurgical processes.*

Occurrence of metals –basic metallurgical operations and metallurgy process – General methods involved in extraction of metals- concentration of ores – froth floatation, magnetic separation,

calcination, roasting, smelting, flux, aluminothermic process. Extraction processes – Chemical reduction – electrolytic reduction – metal displacement – refining methods – distillation – fractional crystallization – electrolysis. Zone reining – van Arkel de Boer methods – electrolytic refining – ion exchange method – muffle furnace – chemical properties – important compounds and uses o Cr, Mn, Co, Ni and Zn.

Outcome: *Students to know the basics of metallurgy and the principles of extraction and refining on metals.*

Unit – V: GAS AND LIQUID STATE

Objectives: *To study the gas laws , physical properties of liquids and the classification of liquid crystal* Ideal gas: Kinetic theory of gases - derivation of gas laws – Maxwells distribution of molecular velocities - Types of molecular velocities - Expansivity and compressibility – collision diameter – collision frequency – mean free path. Behaviour of real gas – Vander Waals equation of state – Boyle temperature – Virial equation of state – critical constants of gas. Liquid state: Physical properties – vapour pressure – Trouton's rule – surface tension – Effect of temperature on surface tension – viscocity – effect of pressure and temperature. Refraction. Liquid crystals: Vapour pressure temperature diagram – thermography – classification of liquid crystals – nematic, smetic and cholesteric liquid crystals with examples.

Outcome: *Students can learn about the behavior of gases and liquids and can solve the problems regarding molecular velocities.*

Reference Books:

1. Arun Bahl and B.S. Bahl, A Text Book of Organic Chemistry, ^{22nd}edn, S Chand & Company, 2016.
2. I. L. Finar, Organic Chemistry Vol-1& 2, 6^{th}edn, Pearson Education Asia, 2004.
3. A.I. Vogel, A Textbook of Quantitative Inorganic Analysis, ELBS and Longman London, 1975.
4. *P. L. Soni*, Mohan Katyal, Text book of *Inorganic Chemistry,* 20^{th} Edition, Sultan Chand & Sons, New Delhi, 2007.
5. B.R. Puri and L.R. Sharma and K.C. Kalia, Principles of Inorganic Chemistry, Shoban Lal Nagin Chand and Co, 1990
6. R.D.Madan, "Advanced Inorganic Chemistry"

CORE PAPER IV

ORGANIC ANALYSIS

EXPERIMENTS IN ORGANIC ANALYSIS

Systematic analysis of an organic compound Preliminary tests, detection of elements present, Aromatic or Aliphatic, Saturated or unsaturated, nature of the functional group, confirmatory tests and preparation of derivatives - Aldehydes, Ketones, Amines, Amides, Diamide, Carbohydrates, Phenols, esters, acids and nitro compounds.

Books for Reference

1. Venkateswaran V. Veeraswamy R. Kulandaivelu A.R., Basic Principles of Practical Chemistry, 2nd edition, New Delhi, Sultan Chand & Sons (1997)

2. Furniss, B.S., et al. Vogel's Textbook of Practical Organic Chemistry, 7th edition, London, ELBS - Longman (1984).

ALLIED CHEMISTRY – II
(COMMON TO ALL BRANCHES)

Unit I Co-Ordination Chemistry

Definition of terms-classification of ligands-Nomenclature-chelation-EDTA and its Applications –Werner's Theory-Effective Atomic Number-Pauling's Theory-Postulates-Applications to $(Ni(CO)_4)$, $(Ni(CN)_4)^{2-}$, $(Co(CN)_6^{3-}$ - Merits and demerits of Werner and Pauling's Theory-Biological role of haemoglobin and chlorophyll -Applications of coordination compounds in qualitative and quantitative analysis like separation of copper and cadmium ions; Nickel and cobalt ions; identification of metal ions like Cu, Fe and Ni-Estimation of Nickel using DMG.

Unit II Metallurgy

Occurrence of metals – Principles of metallurgy – basic metallurgical operations and metallurgy process – General methods involved in extraction of metals –concentration of ores – froth floatation, magnetic separation, calcinations, roasting, smelting, flux, aluminothermic process Extraction processes – Chemical reduction – electrolytic reduction – metal displacement – Refining methods – distillation – fractional crystallization – electrolysis Zone refining – van Arkel de Boer methods – Electrolytic refining.

Unit III Biomolecules

Classifications, preparation and reactions of glucose-open and ring structure of glucose. Mutarotation. Interconversion of glucose to fructose and vice versa - Amino acids: Classification, preparation and properties of alanine -preparation of dipeptide using Bergman method. Proteins -Classification - Denaturation and colour reactions of Proteins - Nucleic acids: DNA and RNA-their components and biological functions.

Unit IV Electrochemistry

Galvanic Cells - emf - standard electrode potential - reference electrodes - Electroplating process -Nickel and Chrome plating - Different type of cells - primary cell, secondary cell and fuel cells - Conductometric titrations - Definition of pH and its determinations by colorimetric method. Buffer solution – Henderson's equation - Applications of buffer solution in biological process and industries – Corrosion and its prevention.

Unit V Analytical Chemistry

Introduction to Qualitative and Quantitative Analysis - Principle of volumetric analysis - Separation techniques - extraction - distillation - crystallization - Chromatographic separations - Principles and applications of column, paper and thin layer chromatography.

TEXT BOOKS

1. Dr .Veeraiyan V., Text book of Ancillary Chemistry, Highmount Publishing house, Chennai-14. Edition-2006.

2. Soni P.L. and Others, Textbook of Organic chemistry, Sultan Chand and Company, New Delhi, Edition-2006.
3. Soni P.L. and Others, Text book of Inorganic Chemistry, Sultan Chand and Company, New Delhi, Edition-2006.
4. Puri B.R., Sharma and Pathania, Text book of Physical Chemistry, Vishal Publishing Co., New Delhi. Edition-2006.
5. Dara S.S., Text book of Environmental chemistry and Pollution Control.- S.Chand and Co., NewDelhi, Edition 2006.

ALLIED CHEMISTRY PRACTICALS
(Common to All Branches)

EXPERIMENTS:

1. Estimation of Sodium hydroxide using standard Sodium Carbonate.
2. Estimation of Hydrochloric acid using standard Oxalic acid.
3. Estimation of borax using standard sodium carbonate
4. Estimation of Ferrous sulphate using standard Ferrous ammonium sulphate
5. Estimation Oxalic acid using standard Ferrous Sulphate
6. Estimation of Potassium Permanganate using standard Sodium hydroxide
7. Estimation of Magnesium using EDTA.
8. Estimation of Ferrous ion using diphenylamine as internal indicator.
9. Estimation of hardness of water using standard EDTA

NON MAJOR ELECTIVE- II

INDUSTRIAL CHEMISTRY

UNIT I Water treatment, purification and water management

Water pollutants – water treatment- methods of treatment - sedimentation, coagulation, filtration - removal of micro organisms - chlorination, adding bleaching powder, UV irradiation and ozonisation- Determination of contaminants- Electrical conductivity - turbidity - pH, total solids, TDS - alkalinity - hardness – Soft water and hard water- removal of hardness by ion exchange method- Rain water harvesting.

UNIT II Energy Resources

Sources-renewable and non-renewable energies- effect of using fuels on the environment- solar energy-technology and advantages of using solar energy- hydrogen as fuel-its advantages- Rocket propellants – batteries- types and its impact on the environment.

UNIT - III Paper Chemistry

Paper- source and its composition- steps involved in paper making-paper stability-environmental impact-paper mills in India- paper products-paper board and its uses.

UNIT IV Leather Chemistry

Leather-sources and composition-steps involved in leather processing-uses of leather-stability of leather-environmental impact. Chemistry of chrome tanning. Dyeing of leather- Tannery effluents-pollution and control.

UNIT - V Dairy Chemistry

Milk- composition and effectiveness as a diet – heat processing of milk- pasteurization-preservation of milk- deep freeze preservation-dairy products – cheese, butter, ghee and kova. Spray drying technique – milk powder, infant food preparation.

References:

1. Outline of Dairy Technology - Sukumar De
2. Indian dairy products-K.S. Rangappa and K.T. Acharya
3. Polymer chemistry-M.G. Arora-Anmol publications-New Delhi
4. Text-book of Polymer Science - F.W. Billmeyer_New Age International
5. Fundamentals of Leather Science - Woodroffe
6. Applied Chemistry - Theory and Practice - O.P. Vermani and A.K. Narula
7. Industrial Chemistry - B.K.Sharma

SEMESTER III **CORE PAPER V**

GENERAL CHEMISTRY III

UNIT – I: Aromatic Compounds

Objectives: *To know about aromaticity, aromatic electrophilic substitution and synthesis of some important aromatic compounds.*

Aromaticity - definition - Huckel's rule - consequence of aromaticity - stability, carbon-carbon bond lengths in benzene ring, resonance energy - Aromatic electrophilic substitution - general pattern of the mechanism involving σ and π complexes, mechanism of nitration, halogenation, sulphonation, mercuration and Friedel-Crafts reaction - Energy profile diagrams - Activating and deactivating substituents - orientation in mono substituted benzenes - reactions of aromatic side chain - halogenation and oxidation - Methods of formation and chemical reactions of alkylbenzenes, biphenyl, naphthalene and Anthracene - Synthesis of 3-nitrotoluene, 4-bromonitro benzene, 4-bromoacetophenone, 3-(4-nitrophenyl)prop-1-ene, 3-nitrostyrene.

Outcome: *Students can able to know the basic knowledge of aromaticity, aromatic electrophilic substitution and synthesis of some important aromatic compounds*

UNIT – II: p-block elements – Boron and Carbon family

Objectives: *To understand the characteristics of elements of Group III A and IV A and the Chemistry of silicones*

General characteristics of elements of Group III A – Extraction of Boron - Physical and chemical properties of Boron – compounds of boron – Borax, Boric acid, Diborane, Boron nitride – Extraction of Al – Physical and Chemical properties - uses – compounds of aluminium – Al_2O_3, $AlCl_3$, alums – Alloys of aluminium. General characteristics of elements of Group IV A – Allotropic forms of carbon – Chemistry of charcoal – chemistry of oxides of carbon- preparation of Silicon – Physical and chemical properties of Si – Uses – Oxides of silicon – structures of silicates. Chemistry of silicones – Manufacture of glass – types of glasses – ceramics – extraction of lead – physical and chemical properties – Uses – lead pigments.

Outcome: *Students can learn about the p-block elements, Boron and Carbon family.*

UNIT – III: p-block elements – Nitrogen and Oxygen family

***Objectives*:** *To provide the detailed chemistry about p-block elements especially Nitrogen and Oxygen family.*

General characteristics of elements of V A Group – Preparation of nitrogen – Physical and chemical properties of nitrogen – uses – Chemistry of some compounds of nitrogen – hydrazine, hydroxylamine, hydrazoic acid, nitric acid – nitrogen cycle. Preparation of phosphorus – Physical and chemical properties of phosphorus – uses – chemistry of PH_3, PCl_3, PCl_5, $POCl_3$, P_2O_5 and oxyacids of phosphorous – fertilizers – Oxides of nitrogen and Phosphorous – oxoacids of nitrogen and phosphorus. Anomalous behavior of oxygen – Structure and allotropy of elements, ozone, oxides – peroxides, suboxides, basic oxides, amphoteric oxides, acidic oxides, neutral oxides – Oxides of Sulphur – oxoacids of sulphur – sulfuryl compounds – Chemistry of selenium and tellurium.

Outcome: *Students can learn about the p-block elements, Nitrogen & Oxygen family.*

UNIT-IV: COLLOIDS AND NANOMATERIALS

Objectives: *To understand the nature of colloids and nano materials*

Colloids - Distinguishing characteristics of colloids, suspensions and solutions- Types of colloidal dispersions-Optical properties-Tyndall effect– Kinetic properties – Brownian motion-Electrical properties–Helmholtz and diffuse double layers – electro kinetic or zeta potential – electrophoresis and its applications Coagulation – methods of coagulation – Hardy Schultz law – Hofmeister series -Protective colloids – protective action – gold number – applications-Emulsions – classification, preparation, Gels – preparation – properties (thixotropy, syneresis and imbibition). Nanomaterials- introduction-self-assembly – materials and molecules –self assembled mono layers- nano wires- types of nano particles- pure gold, silver and cobalt-metal oxides- alumina and titania- synthesis by physical vapor deposition method-reduction method.

Outcome: *Learn the chemistry of colloids and Nano materials.*

UNIT - V: FIRST LAW OF THERMODYNAMICS AND ITS APPLICATIONS

Objectives: *To understand the basics of first law of thermodynamics and the laws of thermo chemistry*

System-surrounding-Intensive and extensive variables; state and path functions; isolated, closed and open systems-zeroth law of thermodynamics. First law of thermodynamics-mathematical form- Heat capacity, relation between C_P and C_V. Isothermal process: Calculations of w, q, dE and dH for the reversible expansion of ideal gases under isothermal and adiabatic conditions. Joule- Thomson effect-derivation of Joule- Thomson coefficient for ideal gases and real gases, inversion temperatures. Variation of enthalpy change of reaction with temperature (Kirchoff's equation). –Hess's law of constant heat of summation- Bond energy and its calculations.

Outcome: *Students gain knowledge about concept of First law of Thermodynamics and its applications and also explain the laws of Thermochemistry*.

Reference Books:

1. R. D. Madan, Modern Inorganic Chemistry, 3rd revised edition., S. Chand & Company Ltd., Reprint 2014.
2. B.R. Puri, L.R. Sharma, K.K. Kalia, Principles of Inorganic Chemistry, 23rd edition, New Delhi, ShobanLal Nagin Chand & Co., 1993.
3. I. L. Finar, Organic Chemistry Vol-1& 2, 6thedn, Pearson Education Asia, 2004.
4. Bhupinder Mehta and Manju Mehta, Organic Chemistry, 2nd edition, PHI Learning Pvt Ltd, 2015.
5. M.K. Jain and S. C. Sharma, Modern Organic Chemistry, Visal Publishing Co, 2015.
6. N. Tewari, Advanced Organic Reaction Mechanism, 3rd Edition, Books & Allied (P) Ltd, 2011.
7. J. Rajaram and J.C. Kuriacose, Chemical Thermodynamics, Pearson Education, New Delhi, 2013.
8. R.L. Madan, G. D. Tuli, Physical Chemistry, S. Chand, Revised edition, 2014.
9. Arun Bahl and B.S. Bahl, A Text Book of Organic Chemistry, 22ndedn, S Chand & Company, 2016.
10. Textbook of Nanosciene and Nanotechnology - BS Murthy P Shankar, Baldev Raj, BB Rath, and James Murday - Orient Black swan Private Limited - New Delhi, 2013.

ELECTIVE-I
AGRICULTURAL CHEMISTRY

UNIT – I Soil and its composition

Definition of soil - composition of soil- physical properties -significance of physical properties to plant growth. Soil chemical properties – inorganic colloids – clay minerals – amorphous – ion exchange reactions – organic colloids – soil organic matter - humus formation – significance of soil fertility.

UNIT – II Fertilizers

Fertilizer – definition – Nitrogeneous fertilizer – effect of nitrogen on plant growth
Phosphate fertilizer – effect of phosphorus on plant growth – super phosphate – bone meal
Potassium fertilizer – effect of potassium on plant growth. Secondary and micronutrient fertilizers – complex and mixed fertilizers – manufacture, reactions in soils.
Biofertilizers – rhizobium- bacteria-bacillus, pseudomonas, fungi-aspergillus, penicillium.

UNIT – III Manures

Agricultural, industrial and urban wastes – preparation of enriched farm yard manures – compost-oil cakes, fish meal, poultry manures. Preparation of slow release fertilizer – compatibility of fertilizers – preparation of different fertilizer mixtures.

UNIT – IV Plant protection

Pest management and control – Pesticides – definition and classifications – mode of action – impact of pesticides in soil and plants – impact on environment – safety measures in handling. Insecticides – Plant products – Nicotine, Pyrethrum, rotenone, petroleum oils. Inorganic pesticides – Arsenical fluorides, borates.
Organic pesticides – chlorine compounds – D.D.T., B.H.C., methyoxychlor, chloredane, endosulfon. Organophosphorus compounds – carbamic acid derivatives – carbaryl – structure.

UNIT – V Fungicides

Fungicides – Inorganic – sulphur compounds – copper compounds .Organic –Boredezux mixture.Herbicides –boron compounds - chlorates and sulphamates. Organic herbicides – nitro and chlorinated compounds -Propionic acid derivatives – urea herbicides. Rodenticides – Attractance – Repellants.

References:

1. A.J. Daji, 1970, A Textbook of soil science – Asia publishing house – Madras.
2. Donahue, R.L. Miller R.W. and Shickluna, J.C. 1987, Soils- An Introduction to Soils and Plant Growth – Prentice Hall of India (P) Ltd., New Delhi.
3. Colling G.H. 1955, Commerical Fertilizers – Mc Graw Hill Publishing Co., New York.
4. Tisdale S.L., Nelson, W.L. and Benton, J.D. 1990, Soil fertility and fertilizers, Mac Millan publishing company, New York.
5. Hesse, P.R., 1971, A textbook of soil chemical analysis, John Murray, New York.

SEMESTER IV

CORE PAPER VI

GENERAL CHEMISTRY IV

UNIT – I: Haloalkanes and Haloarenes

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

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

Outcome: *Important Name Reactions with mechanism involved in both the preparations and properties of alkyl and aryl halides can be studied. Relative reactivities bring about better understanding to carry out the reaction to get more yield of the products. Synthesis and uses of DDT and BHC promotes the application of the knowledge acquired.*

UNIT- II: Alcohols, Phenols and Ethers

Objectives: *To study the preparation and properties of alcohols, Phenols Ethers and epoxides with mechanisms and to apply the knowledge in the synthesis of alcohol derivatives.*

Preparation of alcohols through reduction, hydroboration, hydration, oxymercuration and Grignard reaction. Reactions of alcohol - with metals, esterification with mechanism, oxidation, dehydration, conversion to alkyl halides. Preparation of phenols - acidity of phenol vs alcohols - relative acid strength of substituted phenols - reactions of phenols - esterification, oxidation, Kolbe's, Reimer-Tiemann, Gattermann, electrophilic substitution reactions. Ethers – preparations, reactions - epoxide - Synthesis of aspirin, 3 and 4-nitro phenol, t-butylmethyl ether and 1-methyl-1-cyclohexanol.

Outcome: *The reactions of Alcohols, Phenols Ethers and Epoxides with mechanisms can be well understood and applied in the synthesis of compounds mentioned and many other important alcohol related compounds in industrial and medicinal fields.*

UNIT - III.1: Halogen family and Noble gases

Objectives**:** *To provide the detailed chemistry about halogen family and noble gases*

General characteristics of halogen with reference of electro negativity, electron affinity, oxidation states, and oxidizing power – peculiarities of fluorine, Hydrides, oxides and oxo acids of halogens

Interhalogen compounds – polyhalide ions – pseudohalogens – preparation, properties and structure of interhalogen compounds

Inert gases – position in the periodic table – isolation from atmosphere – General characteristics – Structure and shape of xenon compounds – XeF_2,XeF_4, XeF_6, $XeOF_2$, $XeOF_4$ – uses of noble gases.

Outcome: *It may give a clear knowledge about halogen family, noble gases and their applications.*

UNIT - III.2: Protic &Aprotic solvents

Objectives: *To understand and gain knowledge towards Acid Base chemistry and non-aqueous solvents.*

Non-aqueous solvents: Classification of solvents – General properties of ionizing solvents-chemical reactions. Water, liquid ammonia, liquid SO_2, Liq. N_2O_4, liq. H_2S, liq. HF, liq. HCN, acetic acid,liq. BrF_3 and oxyhalides as solvents.

Acid Base Chemistry: Theories of acids and bases – Arrhenius, Bronsted-Lowry theory proton donor - acceptor system. Theory of solvent system, Lewis-electron dot system and HSAB principle Usanovich concept.

Acid-base Lux Flood Equilibria: pH of strong and weak acid solutions. Buffer solutions. Henderson equations. Preparation of acidic and basic buffers. Relative strength of acids and bases from ka and K_b values.

Outcome: *Students can gain the knowledge about the Acid-base chemistry*.

Unit – IV: Thermodynamics – II

Objectives: *To study the second law of thermodynamics, the concept of entropy, concept of Gibbs Free energy and their applications.*

Second law of thermodynamics – Need for second law – statements of Second law - Carnot theorem, Carnot cycle – Efficiency of heat engine. Concept of entropy – State function – entropy change in isothermal expansion of ideal gas - Entropy change in reversible and irreversible process – Entropy change accompanying by change of phase – calculation of entropy change of an ideal gas with changes in pressure, volume and temperature – Entropy of mixing – Physical significance of entropy. Gibbs free energy – Work function – Variation of free energy change with temperature and pressure – Maxwell's relationship – Criteria for spontaneity – Gibbs Helmholtz equation – Partial molar properties – Clapeyron Clausius equation and its applications Third law of thermodynamics – Nernst heat theorem – statement of third law – Determination of absolute entropies of solids, liquids and gases.

Outcome: *Students can acquire knowledge about second and third law of thermodynamics*

Unit – V - Chemical kinetics

Objectives: *To understand the kinetics and the theories of reaction rate.*

Definition of order and molecularity – rate of reaction - derivation of rate constant of a first, second order reaction - second order reaction (i) When reactants are taken at same initial concentration (ii) When reactants are taken at different initial concentration – derivation of third order rate constant when the reactants are taken at same initial concentration – derivation of half-life period. Effect of temperature on reaction rate – Arrhenius equation – concept of activation energy. Collision theory – derivation of rate constant of a bimolecular reaction – failures of CT – Lindemann theory of unimolecular reaction. Theory of absolute reaction rate – derivation of rate constant of a bimolecular reaction – comparison between ARRT and CT – Significance of free energy of activation and entropy of activation- Consecutive,parallel and reversible reactions(only definition and example)

Outcome:*Students can gain knowledge about kinetics and its theories and can solve the problems related to kinetics*

Reference Books:

1. R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th edition, prentice hall, 1992.
2. Arun Bahl and B.S. Bahl, A Text Book of Organic Chemistry, 22ndedn, S Chand & Company, 2016.
3. I. L. Finar, Organic Chemistry Vol-1, 6th edn, Pearson Education Asia, 2004.
4. R. D. Madan, Modern Inorganic Chemistry, 3rdedn, S. Chand & Company Ltd., Reprint 2014.
5. P.L. Soni, Text book of Ionrganic Chemistry, 20thedn, Sultan chand& Sons, 2000.
6. B.R. Puri, L.R. Sharma, K.K. Kalia, Principles of Inorganic Chemistry, 23rdedn, New Delhi, ShobanLal Nagin Chand & Co., 1993.
7. N. Kundu and S.K. Jain, Physical Chemistry, S. Chand & Company Ltd. 2000
8. G.M.Barrow, Physical Chemistry, 6th edn, McGraw-Hill Inc., US, 1996.

CORE PAPER VII
INORGANIC QUALITATIVE ANALYSIS

Qualitative Analysis

Qualitative analysis of a mixture containing two cations and two anions of which one will be an interfering ion. Semimicro methods using the conventional scheme with hydrogen sulphide may be adopted.

CATIONS TO BE STUDIED: Lead, Copper, Bismuth, Cadmium, Iron, Aluminum, Zinc, Manganese, Cobalt, Nickel, Barium, Calcium, Strontium, Magnesium and Ammonium.

ANIONS TO BE STUDIED: Carbonate, Sulphate, Nitrate, Chloride, Bromide, Fluoride, Borate, Oxalate, and Phosphate.

SEMESTER V **CORE PAPERVIII**

ORGANIC CHEMISTRY I

Unit-I: Isomerism

Objectives: *To understand about stereo chemistry, symmetry elements, optical activity and conformational analysis of acyclic and cyclic compounds.*

Structural isomerism - types with examples – tautomerism – keto-enol, nitro-acinitro, amido-imido. Stereochemistry - Representation of molecules in saw horse, Fischer, flying-wedge and Newman formulae and their inter translations. Symmetry elements - chirality – asymmetric molecules and molecular dissymmetry-pseudo asymmetry. Optical rotation – specific rotation - optical purity - methods of racemization - Optical isomers - enantiomers - diastereomers – epimers - notation of optical isomers - Cahn-Ingold-Prelog rules, R and S notations for optical isomers with one and two asymmetric carbon atoms - erythro and threo representations - D and L representations - Optical activity in compounds without asymmetric carbon atoms namely biphenyls, allenes and spiranes, Stereo selectivity, stereo specificity - asymmetric synthesis. Geometrical isomerism – nomenclature of geometrical isomers – cis/trans, E-Z notation and syn-anti for C=C,C=N compounds - Methods to assign configurations - Stability of geometrical isomers and heats of hydrogenation. Conformational Analysis - Conformation - Conformational nomenclature: eclipsed, staggered, gauche and anti; dihedral angle, torsion angle, energy barrier of rotation - potential energy diagram. Relative stability of conformers on the basis of steric effect, dipole-dipole interaction, H-bonding -Conformational analysis of ethane, propane, n-butane, haloethane, 1,2-dihaloethane, 1,2-glycol,and 1,2-halohydrin, cyclopentane, cyclohexane and mono substituted cyclohexanes.

Outcome: *Students can gain the knowledge on stereo chemistry, symmetry elements, optical activity and conformational analysis of acyclic and cyclic compounds..*

Unit-II: Carbonyl Compounds and their Derivatives:

Objectives: *To know the (i) Methods of synthesis of aldehydes, ketones and carboxylic acids (ii) Mechanism of nucleophilic reactions and (iii) oxidation-reduction reactions.*

Common methods for the synthesis of aldehydes and ketones - synthesis of aldehydes from acid chlorides, Stephen’s reduction - Gattermann-Kosch and Etard reactions - synthesis of ketones

from nitriles, dialkylcadmium, alkyl lithium and lithium dialkylcuprate and Friedel-Crafts and Hoesch reactions. Mechanism of nucleophillic additions to carbonyl group - addition of HCN, alcohols, thiols, sodium bisulfite, Grignard reagents -condensation with ammonia and its derivatives - Aldol, Perkin, Benzoin and Knoevenagel condensations, Wittig reaction, Mannich reaction, Reformatsky reaction and Cannizaro reaction. Oxidation by Tollen's reagent, $KMnO_4$, hypohalite, SeO_2 and peracids. Reduction by H_2/Ni, H_2-Pd-C, $NaBH_4$, $LiAlH_4$, MPV, Clemmenson and Wolff-Kischner reductions. α, β unsaturated aldehydes and Ketones – preparation and reactions. Preparation of carboxylic acids, acidity of carboxylic acids, effects of substituents on acid strength, acidity of aliphatic vs aromatic acids. Reactions of carboxylic acids - Hell-Volhard-Zelinsky reaction, Synthesis of acid chlorides, esters and amides, Reduction of carboxylic acids, methods and mechanism of decarboxylation. Methods of preparation and chemical reactions of a) halo acids b) Hydroxy acids - malic, tartaric and citric acids c) unsaturated monocarboxylic acids d) dicarboxylic acids. Preparation and reactivity of carboxylic acid derivatives - acid chlorides, esters, amides and anhydrides - Mechanisms of esterification and hydrolysis (acid and base catalysed reactions) - Relative stability of acyl derivatives - interconversion of acid derivatives by nucleophilic acyl substitution. Synthesis of active methylene compounds – diethyl malonate and ethyl acetoacetate.

Outcome: *Students can derive an easy and elegance way of giving methods of synthesis of aldehydes/ketones/carboxylic acids, mechanism of nucleophilic reactions and oxidation-reduction reactions*

Unit-III: Nitrogen Containing Compounds

Objectives: *To know the preparation, properties and applications of N-containing compounds.*

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

phase synthesis - classification - primary, secondary, tertiary and quaternary structure of proteins - determination of primary structure with end group analysis.

Outcome: *Students can get the knowledge on preparation, properties and applications of N-containing compounds.*

Unit-IV: Heterocyclic Compounds

Objectives: *To study about the basic concepts, characteristic features, preparation and reaction of heterocyclic compounds*.

Molecular orbital picture and aromatic characteristics of pyrrole, furan, thiophene and pyridine - Comparison between basicity of pyridine, piperidine and pyrrole. Methods of synthesis and chemical reactions with particular emphasis on the mechanism of electrophilic substitution and mechanism of nucleophilic substitution reaction in pyridine derivatives. Preparation and reactions of indole, quinoline and isoquinoline with special reference to Fisher indole synthesis, Skraup synthesis and Bischler-Napieralski synthesis, mechanism of electrophilc substitution reactions of indole, quinoline and isoquinoline.

Outcome: It brings an idea of the synthesis, reactions, applications and important features of heterocyclic compounds.

Unit-V: Rearrangements

Objectives: *To understand about rearrangement reactions and its synthetic applications.*

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

Outcome: It reveals the types of rearrangement reactions and its synthetic applications.

Reference Books:

1 R. T. Morrison and R. N. Boyd, Organic Chemistry, 6th edition, prentice hall, 1992.

2. I. L. Finar, Organic Chemistry Vol-1, 6th edn, Pearson Education Asia, 2004.

3. Ernest L. Eliel, Samuel H. Wilen, and Lewis N. Mander. Stereochemistry of Organic Compounds. New York: Wiley, 1994.

CORE PAPER IX

INOORGANIC CHEMISTRY I

UNIT -I: d-block & f-block elements

Objectives: *The objective of this unit is to introduce the students about the transition and inner transition elements.*

Chemistry of transition elements – electronic configuration – group study of titanium, vanadium, chromium, manganese and iron metals – comparative study of zinc group metals – Important uses of transition metals and their alloys. Horizontal comparison with Fe, Co, Ni groups – toxicity of Cd and Hg – oxides, mixed oxides, halides, and oxohalides of transition metals – synthesis and reactivity of vanadates, chromates, dichromate, molybdates, tungstates, tungsten bronzes, manganate, permanganate – polycations – Interstitial compounds – nitrides, carbides, hydrides, borides of Ti, V, Cr, W and their industrial uses. General characteristics of f-block elements – comparative account of lanthanides and actinides – lanthanide series – separation by ion exchange and solvent extraction methods – lanthanide contraction – actinide series – separation of actinides – oxidation states and general properties – Uranium – occurrence and metallurgy – chemical properties of oxides, hydrides and halides.

Outcome: *The students will acquire knowledge of transition metal alloys, applications of transition and inner transition elements.*

UNIT – II: Coordination Chemistry I

Objectives: *The objective of this unit is to expose the students about the basic concepts of coordination complexes*

IUPAC nomenclature - theories of coordination compounds -Werner, Sidgwick, valence bond, Crystal Field theory. Crystal field splitting in octahedral, tetrahedral and square planar fields – factors influencing the magnitude of crystal field splitting – CFSE in weak and strong fields calculations; pairing energy. Jahn-Teller distortion. Magnetism and Colour: Orbital and spin magnetic moments, spin only moments of d^n ions and their correlation with effective magnetic moments, including orbital contribution; quenching of magnetic moment

Outcome: *The students become familiar with the nomenclature and theories of coordination compounds.*

UNIT – III: Coordination Chemistry II

Objectives: *The objective of this unit is to help the students to understand the facts of reactions and reaction mechanism in complexes.*

Stability of complexes -factors affecting the stability of complexes - Stability constants of coordination compounds and their importance in inorganic analysis. Kinetic verses thermodynamic stability. Experimental determination of stability constant and composition of complexes. Isomerism, reactivity and stability: Determination of configuration of cis- and trans-isomers by chemical methods. Labile and inert complexes, substitution reaction on square planar complexes, trans effect– theories (example and applications). Reaction mechanism – substitution reactions in octahedral complexes – Acid hydrolysis: S_N1 and S_N2 mechanisms

Outcome: *Enable the students to apply the theory to the complexes and applications of coordination complexes in inorganic analysis.*

UNIT – IV: Bioinorganic Chemistry

Objectives: *The objective of this unit is to help the students to understand the development and uses of bioinorganic compounds.*

Metal ions in biology and their vital role in the active site, Structure and functions of Metallo proteins and enzymes. Structures and characteristic features of Haemoglobin and myoglobin – Vitamin B_{12}. Biological functions of haemoglobin and myoglobin, cytochromes and ferredoxins, carbonate bicarbonate buffering system and carbonic anhydrase. Biological nitrogen fixation, Photosynthesis: Photosystem-I

Outcome: *The students will have a better understanding of hemoglobin, myoglobin vitamin B_{12} and role of metal ions in biological systems.*

UNIT – V: Organometallic Chemistry

Objectives: *This unit is designed to enable the students to make sense of bonding in organometallic compoundsand photochemistry oforganometallic compounds.*

Introduction - Structure and application -metal carbonyls -mono and poly nuclear carbonyls of Ni, Fe, Cr, Co and Mn -synthesis and structure -nitrosyl compounds -classification, preparation and properties -structure of nitrosyl chloride and sodium nitroprusside.

Nomenclature of organometallic compounds, 16- and 18- electron rule. Structure and bonding in transition metal carbonyls :polynuclear carbonyls, bridging and terminal carbonyls, transition metal alkyls, carbenes, and carbynes, and metallocenes. Photochemistry of organometallic

compounds -Wilkinson's catalyst and alkene hydrogenation, hydroformylation, Monsanto acetic acid process, Ziegler – Natta catalyst and polymerization of olefins.

Outcome: *The students will able to identify the bonding in organometallic compoundsand photochemistry of organometallic compounds.*

Reference Books

1. Soni, P.L. and Mohan Katyal, Textbook of inorganic chemistry, 20th ed., New Delhi, Sultan Chand & Sons, 2006

2. Puri B.R., Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, New Delhi, 2002

3. Lee J.D., Concise Inorganic Chemistry, ELBS Edition

4. Madan R.D., Tuli G.D., and Malik S.M., Selected Topics in Inorganic Chemistry, S.Chand & Co, New Delhi, 2006

CORE PAPER X

PHYSICAL CHEMISTRY I

Unit-I: Electrical Conductance and Transference

Objectives: *To know the fundamental concepts of conductance studies ii) To understand theory of strong electrolytes* Metallic and electrolytic conductors – specific, equivalent and molar conductance – measurement of molar conductance – variation of molar conductance with dilution for strong and weak electrolytes (qualitative explanation). Transport number and its determination by Hittorff and moving boundary method – effect of temperature and concentration – ionic mobility and ionic conductance – Kohlrausch law and its applications – Applications of conductivity measurements – degree of hydrolysis, solubility product and conductometric titrations. Theory of strong electrolytes – Debye-Huckel-Onsager theory – verification of Onsager equation – Wein effect and Debye-Falkenhangen effect – ionic strength – activity and activity coefficients of strong electrolytes.

Outcome: *students can gain knowledge on electro chemical conductance and the applications of conductance measurements.*

Unit-II: Galvanic Cells and Applications

Objectives*: i) To learn the fundamentals of electro chemical cells and the calculations of cell potential ii) To know about the electrodes and electro chemical series and its applications*

Galvanic cells – reversible and irreversible electrodes and cells – standard cell-emf and its measurement – types of electrodes – electrode reactions – electrode potentials - reference electrodes – standard electrode potentials. Derivation of Nernst equation for electrode potential and cell emf – sign conventions – electrochemical series and its applications – formation of cells – electrode and cell reactions – cell emf. Chemical cells and concentration cells with and without transference – examples and derivation of expressions for their emfs – liquid junction potential.

Outcome: *students can learn about the galvanic cells and its applications*

Unit-III: Applications of emf measurements

Objectives**:** *i) To understand various applications of EMF measurement ii) To study about the storage cells and fuel cells iii) To know the principles of polarography*

Applications of emf measurement – calculation of G, H, S and equilibrium constants –

determination of pH using quinhydrone and glass electrodes – potentiometric titrations. Applications of concentration cells – determination of valency of ions – transport number – equilibrium constant – solubility product – activity coefficients of electrolytes. Polarization – decomposition potential – over-voltage – storage cells – lead acid battery, Ni-Cd, Li-Fe battery – mechanism of discharging and recharging – fuel cells (H_2-O_2).

Outcome: *students can gain knowledge on the determination of pH, storage cells and fuel cells. They can study on principle and applications of polarography*

Unit – IV: Group theory

Objective**:** *To equip learners with concepts of symmetrical elements and outcome*

Symmetry elements – symmetry operations – various point groups with examples – point groups – identification and determination – group multiplication table of C_{2V} and C_{3V} Point groups - Matrix representation of symmetry operations.

Outcome: *Students can learn the basics of group theory*

Unit-V: Spectroscopy –I

Objectives**:** *To know the basic principles of spectroscopy ii) To learns the principles of rotational spectroscopy* Regions of electromagnetic spectrum – properties of electromagnetic radiation - concept of frequency, wavelength, wave number, energy, energy levels, quantization. Interaction of electromagnetic radiation with matter. Basic principles of atomic and molecular spectroscopy. Statement of Born-Oppenheimer approximation. Diatomic molecules - Energy levels of a rigid rotor, selection rules, spectral intensity. Distribution using population distribution (Maxwell-Boltzmann distribution) - determination of bond length - qualitative description of non-rigid rotor - isotope effect.

Outcome: *students can gain knowledge on general basic principles of spectroscopy. students can acquire knowledge on rotational spectroscopy and its applications.*

Reference Books:

1. Puri B.R., Sharma L.R and Pathania M.S., Principles of Physical Chemistry, 47th ed., Vishal Publishing Company, 2016
2. Sharma .K.K, Sharma.L.K. A Text book on physical Chemistry, 6th ed., Sultan Chand, 2016.
3. Maron S.H.and Lando J.B. Fundamentals of Physical Chemistry, Macmillan.
4. Glasstone S. and Lewis. D., Elements of Physical Chemistry. Macmillan

ELECTIVE II

PHARMACEUTICAL CHEMISTRY

Objectives:*i) The student is expected to learn about important drugs and the mode of action ii) Health management and drug development*

Unit – I: Basic Pharmaceutical Chemistry

Objectives: *To know the Definition and important terms involved in the Pharmaceutical Chemistry, and find out the symptoms and drugs for chronic diseases.*

Definition of the following terms: drug, pharmachophore, 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.

Outcome*: Can able to study about the important terminologies of Pharma Chemistry, and brings about the knowledge towards Indian Medicinal Plants.*

Unit – II: Antibacterials

Objectives: *To understand sulpha drugs, Antibiotics and their classifications and also know the information about Antiseptics and disinfectants.*

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.

Outcome*: Can able to know about Sulpha drugs, Antibiotics and their important features, and gives the clinical uses of Antiseptics and disinfectants.*

Unit – III: Analgesics and CNS stimulants

Objectives: *To provide the Definition and importance of Analgesics and its classifications, and study the Antipyretic drugs, Drugs that influences CNS.*

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.

***Outcome**: Gives a knowledge towards the Basic information about Analgesics, Anti pyretic drugs, and the drugs affecting CNS; and its examples.*

Unit – IV: Anasthetics and Drugs for Chronic diseases

***Objectives:** To study Anaesthetics and its classifications, and provide the important aspects of cancer antineoplastics, diabetes and Blood related factors.*

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.

***Outcome**: Brings about a clear idea towards Anaesthetics and its significants, and provide the importantance of the drugs for cancer, Diabetes, AIDS and Blood related diseases.*

Unit – V: Vitamins, Hormones and Enzymes

***Objectives:** To study the Vitamins and its classifications; Harmones and their physiological functions. To know about enzymes and their important aspects and its mechanism of actions.*

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 harmones: Adrenaline, thyroxin, oxytoxin, insulin, the sex harmones. Enzymes – Chemical nature of enzymes, classification of enzymes, properties of enzymes, mechanism of enzyme action. Action of Co-enzymes.

Outcome*: Can brings the knowledge toward Vitamins and their classifications. To give the informations about harmones and enzymes along with their physiological functions and mode of actions through a specific mechanism.*

Reference Books

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

SEMESTER VI

CORE PAPER XI

ORGANIC CHEMISTRY II

Unit-I: Carbohydrates

Objectives: *To understand clearly about the classification and structural features of Carbohydrates.*

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

Outcome: *Students can able to notify different types of carbohydrates and its structural properties*

Unit-II: Synthetic methodology and reagents

Objectives: *To know the synthetic strategies and terminologies involved in organic synthesis and the role of important reagents in organic synthesis.*

Synthetic terminology - Disconnection, synthon, synthetic equivalent (SE), Functional group interconversion (FGI), Target molecule (TM).- retro synthetic analysis - Linear, Convergent and Combinatorial syntheses. List of Nucleophilic reagents and electrophilic reagents. Synthetic applications of malonic ester and ethylacetoacetate in the synthesis of a) monocarboxylic acids (propionic acid and n-butyric acid). b) dicarboxylic acids (succinic acid and adipic acid). c) α,ß-unsaturated carboxylic acids d)heterocyclic compounds. Retrosynthesis of the following molecules 4-methyl acetophenone, methylcyclohex-3-enecarboxylate, phenylethylbromide, 2-

methylcyclopentane and 2-allyl phenol. Role of following reagents in organic synthesis: DIBAL, Gilmann reagent, DCC, trimethylsillylchloride and methyllithium

Outcome: It brings about the synthetic strategies and terminologies involved in organic synthesis and the role of important reagents in organic synthesis.

Unit-III: Natural Products and Biochemistry

Objectives: *To learn the classification, structure and properties of Alkaloids, Terpenoids, Steroids, Hormones, Amino acids and proteins.*

Alkaloids: Definition - classification with suitable examples for each class - properties - structural determination - Sources, isolation, physiological activities and structure of piperine, conine, cocaine and quinine. Terpenoids: definition, isoprene rule and classification with suitable examples - Isolation, properties, structure and uses of citral, geraniol and limonene. Steroids and Hormones: definition - classification - Occurrence, structure and physiological activities of cholesterol, estrogens and testosterone. Amino acids and proteins: Definition - classification - Essential amino acids - Peptide linkage - protein formation from amino acids - Structure of proteins - Tests for amino acids and proteins.

Outcome: *Students can learn about the classification, structure and properties of Alkaloids, Terpenoids, Steroids, Hormones, Amino acids and proteins.*

Unit-IV: Industrial Organic Chemistry

Objectives: To know the applied chemistry in the form of synthesizing Dyes, and rubbers; and also enable the green chemistry which brings about ecofriendly green products.

Dyes - theory of color and constitution - chromophore, auxochrome, classification according to application and structure - preparation and uses of azo dyes - methyl orange, triphenyl methane dyes - malachite green, indigo dyes - Indigotin, anthraquinone dyes - alizarin, phthalein dyes – fluorescein. Polymers-definition- classification -mechanism of cationic, anionic and free radical polymerisation – preparation of Nylon 66, Nylon 6, Dacron, Bakelite, melamine, neoprene, Buna-N, Buna-S and biodegradable polymers - molecular weight of polymers (elementary treatment). Green Chemistry - Definition, need and basic principles of green chemistry - green synthesis - Aqueous phase reactions, reactions in ionic liquids, Solid supported synthesis, Solvent free reactions (solid phase reactions), - Green catalysts - Phase transfer catalysts (PTC)

and Biocatalysts. Microwave and Ultrasound assisted green synthesis- green chemical synthesis of Paracetamol.

Outcome: *Students can able to identify the green route, to apply the synthesis of Dyes and Rubbers in the Industry; and also give an idea towards Microwave and ultrasound methods.*

Unit-V: Applications of Spectroscopy

Objectives: *To study the basic concepts involved in spectroscopic techniques of UV, IR, NMR and Mass spectroscopy and their instrumentation techniques along with its applications.*

UV and Visible Spectroscopy: Possible electronic transitions in an organic compound. Selection rule. Solvent effect. Chromophore and auxochromes. Various types of shifts in λ max and in ϵ max. Calculation of λ max of an organic compound. Applications of UV and Visible spectroscopy in organic Chemistry. Infrared spectroscopy: Various types of vibrations and number of vibrational degrees of freedom. Selection Rules-Solvent effect. Effect of Hydrogen bond - Finger print region. The characteristic ranges of absorption of IR radiation of various functional groups. Spin Resonance Spectroscopy: NMR active nuclei. Equivalent and non-equivalent protons and number of signals. Reference compound TMS. Relative signal intensities and number of hydrogens. Chemical shift and various factors influencing chemical shift. Spin-spin splitting, splitting constant, NMR spectrum of simple molecules. Mass Spectrometry:Basic principles - instrumentation - Representation of mass spectrum. Molecular ion -identification of parent ion - isotopic peaks - Determination of molecular formula - meta stable peak. General fragmentation – McLafferty rearrangement - Retro-Diels-Alder rearrangement. Mass spectra of ethylbenzene, methoxyethane, acetophenone, n-butyl amine, 1- proponal and 1-pentanol.

Outcome: *Can able to know all the spectroscopic techniques in the electromagnetic spectrum. Study of Instrumentation techniques very much useful to identify the simple as well as complex organic molecules.*

Reference Books:

1 I. L. Finar, Organic Chemistry Vol-1, 6th edn, Pearson Education Asia, 2004.

4. 5. R. Silverstein, M., Bassler, G. C., Morrill, T. C. Spectrometric Identification of Organic Compounds , John Wiley and Sons, INC, Fifth edition, 1991.

6. W. Kemp, Organic Spectroscopy, Palgrave, 1991.

7. J.R. Dyer, Application of Absorption Spectroscopy of Organic Compounds, Prentice-Hall of India Pvt.Ltd, 2010.

Core PAPER XII

INORGANIC CHEMISTRY II

Unit –I: Nuclear Chemistry I

Objective: *The objective of this unit is to introduce the students about the composition and stability of the nucleus and types of nuclear reactions.*

Introduction – composition of nucleus and nuclear forces – nuclear stability – mass defect – binding energy – packing fraction – N/P ratio – magic numbers – nuclear models – liquid drop – Shell and collective model. Isotopes – detection and separation – deviation of atomic weights from whole numbers – isobars, isotones and isomers – Radioactive decay and equilibrium – nuclear isomerism – internal conversion. Nuclear Q-value – threshold energy – cross sections, types of reactions – fission and fusion – modes of radioactive decay.

Outcome: *The students become familiar with the concepts of nuclear reactions.*

Unit –II: Nuclear Chemistry II

Objective: *The objective of this unit is to enlighten the students about the Natural and artificial radioactivity.*

Natural and induced radioactivity – radioactive decay – half-life period – radioactive displacement law – radioactive series – Radioactive techniques – Geiger Muller and ionization counters. Natural radioactivity – Detection and measurement of radioactivity – radioactive series including neptunium series – group displacement law – Rate of disintegration and half-life period – Average life period. Artificial radioactivity – induced radioactivity – uses of radioisotopes – hazards of radiations – nuclear energy – nuclear reactors – nuclear fission and fusion – fission products and fission yields – Spallation – photonuclear and thermo nuclear reactions – energy source of the sun and stars – carbon dating – rock dating. radioactive waste disposal – applications of nuclear science in agriculture, biology and medicine – Atomic power projects in India.

Outcome: *The students will gain knowledge about atom bomb, hydrogen bomb and applications of radioisotopes in agriculture and medicine, and atomic power projects in India.*

Unit –III: Solid State Chemistry

Objective: *The objective of this unit is to expose the students to the basic concepts of structure of solids, electrical and magnetic properties of solids.*

Ionic bonding – lattice energy – Born equation and its derivation, radius ratio rules – structures

of some ionic crystals – Structure of solids – comparison of X-ray and Neutron diffraction – derivation of Bragg's equation. Spinels and inverse spinels – defects in solids, non-stoichiometric compounds – Electrical, Magnetic and optical properties of solids – band theory – semiconductors – superconductors. Solid state electrolytes – Types of magnetic behavior, dia, para, ferro, antiferro and ferrimagnetism – Hysterisis – Solid state lasers – inorganic phosphors – ferrites.

Outcome: *The students will have a better understanding of the applications of XRD, semiconductors, superconductors and solid state lasers.*

Unit –IV: Structure of Solids

Objective: *The objective of this unit is to help the students to understand the facts of crystal systems and structure of solids.*

Classification of solids – amorphous and crystalline solids – Van der waals crystals – covalent crystals – Laws of crystallography – Elements of symmetry – Weiss and Miller indices – Crystal systems and Bravais lattices. Structure of ionic solids – crystal structures – Sodium chloride, Zinc blende, wurtzite, rutile, Cesium chloride, fluorite – antifluorite – Identification of simple cubic, bcc, fcc lattices and indexing of X-ray lines. Crystal defects – Schottky and Frenkel defects – F-center.

Outcome: *The students acquire knowledge of crystal structures and crystal defects*

Unit –V: Material Chemistry

Objective: *The objective of this unit is to know the role and function of conductors, superconductors and solid state materials.*

Ionic conductors – sodium, β- alumina, sodium-sulphur battery. Intercalatin – layered compounds – graphitic compounds. Special applications of solid state materials. High energy battery, lithium cells. Introduction – techniques for synthesis of nanophase materials –sol-gel synthesis- electro deposition –inert gas condensation-mechanical alloying –properties of nanophase materials –applications of nanophase materials, composite materials.

Superconductivity – introduction,– examples of superconducting oxides,– applications of superconducting materials.

Outcome: *The students become familiar with the theoretical background of the applications of superconducting materials, nanaophase materials, composite materials, high energy battery and lithium cells.*

Reference Books

1. Soni, P.L. and Mohan Katyal, Textbook of inorganic chemistry, 20th ed., New Delhi, Sultan Chand & Sons, 2006

2. Puri B.R., Sharma L.R., Kalia K.K., Principles of Inorganic Chemistry, New Delhi, 2002

3. Lee J.D., Concise Inorganic Chemistry, ELBS Edition

4. Madan R.D., Tuli G.D., and Malik S.M., Selected Topics in Inorganic Chemistry, S.Chand & Co, New Delhi, 2006

CORE PAPER XIII

PHYSICAL CHEMISTRY II

Unit –I: INFRA RED, RAMAN AND NMR SPECTROSCOPY

Objectives: *i) To understand the principles of IR spectroscopy and its applications ii) To study the basics of Raman spectra and its applications iii) To know the theory and instrumentation of NMR*

IR Spectroscopy; Principle, Simple harmonic oscillator, selection rules, pure vibrational spectrum, Hooke's law, Zero point energy, anharmonicity, determination of force constant, fundamental vibrational frequency and overtone, vibrational modes of CO_2 and H_2O,IR instrumentation and identification of organic molecules from characteristic absorption bands**.** Raman spectroscopy: Rayleigh and Raman Scattering – Stokes and Anti- stokes lines – difference between IR and Raman- mutual exclusion principle- applications**.**

. ***Outcome:*** *Can learn the principles of IR, Raman, NMR spectroscopic and instrumentation techniques and its applications.*

Unit –II: CATALYSIS AND ADSORPTION

Objectives: *i) To learn the nature the characteristics of catalysis and its types ii) To study the phenomenon of adsorption and its applications*

Catalysis- characteristics- - different types-homogeneous-heterogeneous-acid-base catalysis-auto catalysis-theories of catalysis-intermediate compound formation theory and adsorption theory-kinetics of enzyme catalysis - MichaelisMenton equation. – applications of catalysis-Adsorption-definition- - physisorption and chemisorptions - factors influencing adsorption of gases on solids - Langmuir adsorption isotherm – BET equation (no derivation) - Applications of adsorption.

Outcome: *It clarifies the topic of catalysis and its applications, and the also the concept of adsorption and its significance.*

Unit –III: PHASE EQUILIBRIA

Objectives: *i) To understand Phase rule and its application to various systems ii) To use Clausius - Clapeyron equations for the various phase transitions*

Phase Rule: Concepts of phase, component and degrees of freedom, with examples. Gibb's phase rule – derivation. One-component system: Phase diagrams: Water and sulphur systems. Two component system: (i) Simple eutectic: Lead-silver system- Formation of compound with congruent melting point: Ferric chloride – water system. Clausius - Clapeyron equations and their applications to equilibria in phase transitions. (solid – liquid, liquid – vapour, solid – vapour).

Outcome: *Brings about the theory of phase rule and its applications to various systems; and to study the clausius clapeyron equations.*

Unit –IV: SOLUTIONS AND COLLIGATIVE PROPERTIES

Objectives*: i) To understand Raoult's law, non-ideal solutions and Colligative properties ii) To derive the thermodynamic relationship between vapour pressure and Colligative properties*

Thermodynamics of ideal solutions: Ideal solutions and Raoult's law, deviations from Raoult's law – non-ideal solutions. Henry's law - Vapour pressure-composition and temperature composition curves of ideal and non-ideal solutions. Distillation of solutions. Lever rule. Azeotropes. Partial miscibility of liquids: Critical solution temperature; effect of impurity on partial miscibility of liquids. Immiscibility of liquids- Principle of steam distillation. Nernst distribution law and its applications. Colligative properties- elevation of boiling point, depression in freezing point – Abnormal behavior of solutions of electrolytes.

Outcome: *i) Gives an explanation about ideal and non-ideal solutions and its applications ii) Interprets the relationship between vapour pressure and colligative properties.*

Unit –V: PHOTOCHEMISTRY

Objectives: *i) To understand various types of photochemical process ii) To study the laws of photo chemistry iii) To learn the kinetics of photochemical reactions*

Laws of photochemistry - Grothus-Drapper law – Stark-Einstein law of photochemical equivalence – Quantum efficiency – determination of quantum efficiency – chemical actinometry – consequence of light absorption – *Jablonski* diagram – radiative and non-radiative transitions – photochemical reactions – kinetics of photochemical combination of H_2-Cl_2, H_2-Br_2

and decomposition of HI – Energy transfer in photochemical reactions – photosensitization - photosynthesis in plants – Theory of Fluorescence and Phosphorescence – Chemiluminescence and bioluminescence.

Outcome: *Gain knowledge about photochemical reactions.*

Reference Books

1. S. Glasstone and D.H. Lewis, Elements of Physical Chemistry, 2nd Edition, Macmillan &Company, UK, 1962.
2. P.W. Atkins, J. D. Paula Elements of Physical Chemistry, Oxford University Press,2017
3. B.R. Puri, L.R. Sharma and M.S. Pathania, Principles of Physical Chemistry, 46th Edition, Vishal Publishing Company, New Delhi, 2013.
4. P.L. Soni, O.P. Dharmaha and U.N. Dash, Textbook of Physical Chemistry, 23rd Edition, Sultan Chand & Sons, New Delhi, 2011.
5. R.L. Madan, G. D. Tuli, Physical Chemistry, S. Chand, Revised edition, 2014

CORE PAPER XIV

PHYSICAL CHEMISTRY EXPERIMENTS

1. Determination of partition coefficient of Iodine between carbon tetra chloride and Water.
2. Determination of rate constant of acid-catalysed hydrolysis of an ester (Methyl acetate or Ethyl acetate).
3. Determination of kf / molecular weight by Rast's macro method-Naphthalene, Diphenyl and diphenylamine.
4. Determination of critical solution temperature of Phenol-Water system.
5. Determination of concentration of an electrolyte (NaCl/KCl/succinic acid).
6. Phase Diagram – Simple Eutectic system.
7. Determination of cell constant, specific conductivity and equivalent conductivity of strong electrolyte.
8. Determination of dissociation constant of a weak acid (acetic acid).
9. Conductometric titrations, strong-acid-strong base.

CORE PAPER XV

GRAVIMETRIC ANALYSIS

1. Estimation of Sulphate as Barium Sulphate.
2. Estimation of Barium as Barium Chromate.
3. Estimation of Lead as Lead Chromate.
4. Estimation of Calcium as Calcium Oxalate.
5. Estimation of Nickel as Nickel Dimethyl glyoximate.

ELECTIVE III

ANALYTICAL CHEMISTRY

Unit – I: Basic concepts of analytical chemistry

Objectives: *To provide the basic idea about the instrumental analysis and analytical techniques, along with handling the laboratory techniques and safety procedures.*

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.

Outcome: *Students can enable to handling the instruments with the proper analytical methods and also gives the safety measurements towards the laboratory techniques.*

Unit – II: Errors and their Evaluation

Objectives: *To know about important terminologies involved in Error analysis, and find out sources of error, Methods of reporting analytical data.*

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.

Outcome: *It brings about terms and methods of finding error analysis, and can able to determine the sources of errors and its effects towards analytical results.*

Unit – III: Titrimetric Analysis

Objectives: *To understand the concepts of theory behind the titrimetric analysis, concentration units, standard solutions, strong & weak acid, base etc; including redox and EDTA titrations.*

Theoretical considerations of titrimetric analysis – classification of reactions in titrimetric analysis – standard solutions – concentration units – primary and secondary standards –

Neutralization indicators – apparent indicator constant – universal or multiple – Range indicators. Neutralization curves – Neutralization 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.

Outcome: *It can enable the methods for doing titrimetric techniques along with the details of aqueous & non-aqueous solvents, strong and weak acid base concepts.*

Unit– IV: Gravimetric Analysis

Objectives: *To provide the principles of gravimetric analysis, methods and characteristic features of precipitation techniques, and the analysis of thermal analytical methods.*

Principles of gravimetric analysis – characteristics of precipitating agents – choice of precipitants and conditions of precipitation – specific and selective precipitants – DMG, cupferron, salicyladehyde, 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 thermo gravimetric analysis and differential thermal analysis.

Outcome: *Brings about the methods of gravimetric analysis; can able to know the concepts and methods of precipitation techniques and Thermal Gravimetric Analysis.*

Unit – V: Separation Methods

Objectives: *To study about the principles and classification of separation methods, and also to provide, the methods of separation techniques and its applications.*

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 – Rf 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.

Outcome: *Clearly brings about the principles and methods of separation techniques and their applications.*

Reference Books

1. G.D.Christian, Analytical Chemistry, 5th Ed., John Wiley, 1994.
2. D. A. Skoog and D. M. West, Fundamental of Analytical Chemistry, 7th Edition, International Edition, Saunders College Publishing, Philadelphia, Holt, London, 1996.
3. L.G.Hargis, Analytical Chemistry: Principles and Techniques, Prentice Hall, 1988.
4. D.A. Skoog, Principles of Instrumental Analysis, Saunders College Pub. Co, III Edn., 1985.
5. R.A.Day, Jr. and A.L.Underwood, Quantitative Analysis, 6^{th} edition, Prentice Hall, 1991.
6. S.M.Khopkar, Environmental Solution Analysis, Wiley Eastern Ltd., New Delhi, 1993.
7. S.M.Khopkar, Basic Concepts of Analytical Chemistry, Wiley Eastern.1984.
8. F.Settle, Handbook of Instrumental Techniques for Analytical Chemistry, Prentice Hall, 1997.