Shri Sangameshwar Education Society's

Sangameshwar College, Solapur [Autonomous]

(Affiliated to Punyashlok Ahilyadevi Holkar Solapur University, Solapur)

Kannada Linguistic Minority Institute

NAAC Accredited with 'A' Grade (III Cycle CGPA 3.39)

Academic Council 4(4.2)
26th March, 2022

UG Science Programme: B.Sc.-III to be implemented from A.Y. 2022-2023

System: Choice Based Credit System (CBCS) with SGPA and CGPA

B.O.S. in: **Chemistry**

Structure of Choice Based Credit System for Undergraduate Science **Program B.Sc. III (Chemistry):** To be implemented from **A.Y.2022-2023**

Table:5

Semester	Course		Course Code	Teaching Scheme/week		
				Hours	Lectures	Credits
V	AECC-C	ENGLISH FOR COMMUNICATION-III	2231501	3.2	4	2
	DSE-1A	Theory Paper-IX: PHYSICAL CHEMISTRY	2231511	2.4	3	3
		Practical-IV: Physical Chemistry Practical	2231616	4	5	2
	DSE-2A	Theory Paper-X: INORGANIC CHEMISTRY	2231512	2.4	3	3
		Practical-V: Inorganic Chemistry Practical	2231617	4	5	2
	DSE-3A	Theory Paper-XI: Organic Chemistry	2231513	2.4	3	3
		Practical-VI: Organic Chemistry Practical	2231618	4	5	2
	ANY ONE from DSE-4A (1) & 4A (2)					
	DSE-4A (1)	Theory Paper-XII: ANALYTICAL AND INDUSTRIAL PHYSICAL CHEMISTRY	2231514	2.4	3	3
		Practical-VII: Analytical Chemistry Practical	2231619	4	5	2
	DSE-4A (2)	Theory Paper-XII: METHODOLOGY AND MATERIALS OF INDUSTRIAL IMPORTANCE	2231515	2.4	3	3

		Practical-VII: Analytical Chemistry Practical	2231619	4	5	2
	SGSEC-3	Theory Paper-III: Computer Applications in Chemistry	2231516	2.4	3	2
		Total		**31.2**	**39**	**24**
VI	AECC-D	ENGLISH FOR COMMUNICATION-IV	2231601	3.2	4	2
	DSE-1B	Theory Paper-XIII: PHYSICAL CHEMISTRY	2231611	2.4	3	3
		Practical-IV: Physical Chemistry Practical	2231616	4	5	2
	DSE-2B	Theory Paper-XIV: INORGANIC CHEMISTRY	2231612	2.4	3	3
		Practical-V: Inorganic Chemistry Practical	2231617	4	5	2
	DSE-3B	Theory Paper-XV: Organic Chemistry	2231613	2.4	3	3
		Practical-VI: Organic Chemistry Practical	2231618	4	5	2
	ANY ONE from DSE-4B (1) & 4B (2)					
	DSE-4B (1)	Theory Paper-XVI: Analytical and Industrial Organic Chemistry	2231614	2.4	3	3
		Practical-VII: Analytical Chemistry Practical	2231619	4	5	2
	DSE-4B (2)	Theory Paper-XVI: Applied Organic Chemistry	2231615	2.4	3	3
		Practical-VII: Analytical Chemistry Practical	2231619	4	5	2
		Total		**28.8**	**36**	**22**
Total Semester V and VI				**60**	**75**	**46**

Table: 6

Semester	Course		EXAMINATION Marks			Credits
			CA	SEE	Total	
V	AECC-C	Theory-IV: ENGLISH FOR COMMUNICATION-III	15	35	50	2
	DSE-1A	Theory Paper-IX: Theory Paper-IX: PHYSICAL CHEMISTRY	30	70	100	3
	DSE-2A	Theory Paper-X: INORGANIC CHEMISTRY	30	70	100	3
	DSE-3A	Theory Paper-XI: ORGANIC CHEMISTRY	30	70	100	3
	ANY ONE from DSE-4A (1) & 4A (2)	Theory Paper-XII: ANALYTICAL AND IND USTRIAL PHYSICAL CHEMISTRY Theory Paper-XII:	30	70	100	3
	SEC-3	Theory Paper-III: Computer Applications in Chemistry	15	35	50	2
	Total		**135+15**	**315+35**	**450+50**	**16**
VI	AECC-D	Theory-V: ENGLISH FOR COMMUNICATION-IV	15	35	50	2

	DSE-1B	Theory Paper-XIII: PHYSICAL CHEMISTRY	30	70	100	3
	DSE-2B	Theory Paper-XIV: INORGANIC CHEMISTRY	30	70	100	3
	DSE-3B	Theory Paper-XV: ORGANIC CHEMISTRY	30	70	100	3
	ANY ONE from DSE-4B (1) & 4B (2)	Theory Paper-XVI: Analytical and Industrial Organic Chemistry Theory Paper-XVI: Applied Organic Chemistry	30	70	100	3
	DSE-1A & DSE-1B	Practical-IV: Physical Chemistry Practical	30	70	100	4
	DSE-2A & DSE-2B	Practical-V Inorganic Chemistry Practical	30	70	100	4
	DSE-3A & DSE-3B	Practical-VI Organic Chemistry Practical	30	70	100	4
	DSE-4A & DSE-4B	Practical-VII Analytical Chemistry Practical	30	70	100	4
		Total	**240+15**	**560+35**	**800+50**	**30**
Total Semester V and VI			**405**	**945**	**1350**	**46**

CA: Continuous Assessment SEE: Semester End Examination

Note:

The above structure (Table-5 and Table-6) is for Sem-V and Sem-VI of the undergraduate B.Sc.-III programmes* under science faculty.

* B.Sc.-III Chemistry/Physics/Mathematics/Statistics/Electronics/Botany/Zoology.

DSE: Discipline Specific Elective Core Course (When a Student opts a particular course$ as a principal course from the core courses opted at B.Sc.- II excluding Geography and Psychology).

$ Chemistry/Physics/Mathematics/Statistics/Electronics/Botany/Zoology

AECC: Ability Enhancement Compulsory Course SEC: Skill Enhancement Course

Passing in each course is compulsory. SGPA/CGPA and Total Marks will be calculated excluding AECC courses.

Programmes	Total Marks	Credits
B.Sc.-I	1200+100+50	52
B.Sc.-II	1300+50	56
B.Sc.-III	1250+100	46
Total	**3750+250+50**	**154**

	Program Outcomes (POs) of B.Sc. (Chemistry) Program
PO No.	After successful completion of three-year degree program in Chemistry a student should be able to;

PO-1.	1. Demonstrate, solve and an understanding of major concepts in all disciplines of chemistry.
PO-2.	2. Solve the problem and also think methodically, independently and draw a logical conclusion.
PO-3.	3. Employ critical thinking and the scientific knowledge to design, carry out, record and analyze the results of chemical reactions.
PO-4.	4. Create an awareness of the impact of chemistry on the environment, society and development outside the scientific community.
PO-5.	5. Find out the green route for chemical reaction for sustainable development.
PO-6.	6. To inculcate the scientific temperament in the students and outside the scientific community.
PO-7	7. Use modern techniques, decent equipment's and Chemistry software's
	Program Specific Outcomes (PSOs) of B.Sc. (Chemistry) Program
PSO No.	**Upon completion of this program the student will be able to**
PSO 1	i) Correlate and apply the theoretical chemistry knowledge in explaining practical schemes ii) Solve numerical problems, mechanisms, analytical interpretation using chemistry concepts and knowledge.
PSO 2	i) Create awareness and promote research attitudes among students. ii) Embrace reduces, recycle and restore chemicals (3R's) approach and gain the sense of ethical, social and environmental awareness and responsibility.
PSO 3	i) Analyse chemical species qualitatively and quantitatively using appropriate Analytical techniques. ii) Understand and apply principles of Organic Chemistry for understanding the scientific phenomenon in Reaction mechanisms.
PSO 4	i) Interpret spectroscopic data to identify basic organic compounds. ii) Create awareness and promote research attitudes among students.

General Structure

Theory Examination:

• Structure of B.Sc. course under faculty of science has total 06 semesters for 3 years.

• B.Sc.-III comprises of total two semesters (Sem-V and Sem-VI).

Each semester will have five theory papers (one is compulsory English and four are Chemistry papers) of 70 marks each (semester end examination) and 30 marks for each paper (continuous assessment).

The duration of each theory paper examination will be of 2 hr. and 30 min.

Each theory paper has 30 marks for continuous assessment. There will be 15 marks unit test and 15 marks home assignment.

• At the end of academic year i.e. semester - VI the practical examination will be conducted.

The Weightage of practical is of 280 marks for SEE practical and 120 i.e (30*4) marks for CA practical examination.

There will be four theory papers in chemistry of 70 marks for each semester. Their titles and marks distribution are as under (Excluding English).

B. Sc.–III Sem-V

DSE-1A-Physical Chemistry

DSE- 2A-Inorganic Chemistry

DSE- 3A-Organic Chemistry

DSE- 4A (I)- Analytical and Industrial Physical Chemistry

OR

DSE- 4A(II)- Methodology and materials of industrial importance

B. Sc.- III Sem-VI

DSE- 1B-Physical Chemistry

DSE- 2B-Inorganic Chemistry

DSE- 3B-Organic Chemistry

DSE- 4B(I)- Analytical and Industrial Organic Chemistry

OR

DSE- 4B(II)- Applied Organic Chemistry

Practical Course

Practical Examination will be held at the end of the year.

A) Distribution of marks:

• **Continuous Internal Assessment for chemistry**:

1) Practical paper has 30*4 = 120 marks for CA.

2) Practical paper has 280 marks for SEE practical.

There will be four practical, one from each Physical, Inorganic, Organic and Analytical practical work.

3) The mark distribution of 280 marks for SEE practical examination is asfollows.

Q. 1 Physical Chemistry experiment: 70 marks

Q. 2 Inorganic Chemistry experiment: 70 marks

Q. 3 Organic Chemistry experiment: 70 marks

Q. 4 Analytical Chemistry experiment: 70 marks

Total marks: 280 marks

Duration of practical examination is four days, six and half hours per day
All answer sheets should be collected at the end of examination.

Practical Marks Distribution

- **Physical Chemistry experiment: 70 marks**
  - a) Instrumental: 30
  - b) Non-instrumental: 30
  - c) Journal: 5
  - d) Oral: 5
- **Inorganic Chemistry experiment: 70 marks**
  - a) Gravimetric analysis: 30
  - b) Volumetric analysis: 15
  - c) Preparation: 15
  - d) Journal:5
  - e) Oral:5
- **Organic Chemistry experiment: 70 marks**
  - a) Organic Mixture Separation and analysis: 30
  - b) Volumetricanalysis: 25
    OR
  - b) Preparation: 25
  - c)Derivative: 5
  - d) Journal:5
  - e) Oral:5
- **Analytical Chemistry experiment: 70 marks**
  - a) Any **two** experiments to be perform (30 + 30 Marks each).
  - b) Journal: 5
  - c) Oral: 5

CHEMISTRY: Syllabus for B.Sc.-III as per CBCS pattern
Theory

N. B.

i.) Figures shown in bracket indicates the total number of contact hours required for the respective topics.

ii) The question paper should cover the entire syllabus. Marks allotted should be in proportion to the number of contact hours allotted to respective topics.

iii) All topics should be dealt with S.I. units.
iv) Use of scientific calculator is allowed.
v) Industrial tour is prescribed.
vi) Values required for spectral problems should be provided in the question paper.

SEMESTER –V

Academic Council 5(5.2)
15th June, 2022

PAPER-IX: DSE-1A

CHEMISTRY-IX (2231511)

Title: PHYSICAL CHEMISTRY

Total Credits: 3 Marks: 100
Contact hrs: 36

Learning objective:

1. To understand the concepts of phase rule and their use in one and two component systems.
2. To learn electromotive force and Nernst equation to apply for various electrodes potential.
3. To know about the laws of photochemistry to use in various process.
4. To learn the fluorescence and phosphorescence phenomenon in photochemistry.

Unit 1: Phase Equilibria. **8**

1.1 Introduction

1.2 Gibbs phase rule: Phase rule equation and explanation of terms involved in the equation.

1.3 Phase diagram, true and metastable equilibria.

1.4 One component systems: (i) Water system (ii) Sulphur system with explanation for polymorphism.

1.5 Two component systems: (i) Eutectic system: (Ag - Pb system); Desilverisation of lead (ii) Formation of compound with congruent melting point ($FeCl_3$ - H_2O)

Unit 2: Electromotive force. **19**

(Convention: Reduction potentials to be used)

2.1 Introduction

2.2 Thermodynamics of electrode potentials (Nernst equation).

2.3 Types of electrodes: Description in terms of construction, representation, half cell reaction and emf equation for,

i) Metal - metal ion electrode. ii) Amalgam electrode.iii) Metal - insoluble salt electrode.

iv) Gas -electrode. v) Oxidation – Reduction electrode.

2.4 i) Reversible and Irreversible cells.

iii) Chemical cells without transference.

iv) Concentration cells

a. Electrode concentration cell

I) Reversible to cation

II) Reversible to anion

b. Electrolyte concentration cells without transference

2.5 Equilibrium constant from cell emf, determination of the thermodynamic parameters such as ΔG, ΔH andΔS.

2.6 Applications of emf measurements:

i) Determination of pH of solution using Hydrogen electrode.

ii) Solubility and solubility product of sparingly soluble salts (based on concentration cell).

2.7 Numerical problems.

Unit 3: Photochemistry. **9**

3.1 Introduction

3.2 Difference between thermal and photochemical processes.

3.3 Laws of photochemistry: Grotthus - Draper law, Lambert law, Lambert - Beer's law (with derivation), Stark – Einsteinlaw.

3.4 Jablonski diagram depicting various processes occurring in the excited state: Qualitative description of fluorescence and phosphorescence.

3.5 Quantum yield, Reasons for high quantum yield (e.g. H_2 - Cl_2) and low quantum yield. (e.g. Decomposition of HI and HBr).

3.6 Photosensitized reactions - Dissociation of H_2,Photosynthesis.

3.7 Photodimerisationofanthracene.

3.8 Chemiluminescence.

3.9 Numerical problems.

Course outcome:

After successful completion of this Course student will be able to-

1. Define the terms in phase equilibria such as- phase, components, degree of freedom, one / two component system, phase rule, etc.
2. Explain eutectic system for desilverisation of silver- lead system.
3. Apply Nernst equation for electrode and cell potentials in terms of activities.
4. Determine of the thermodynamic parameters such as ΔG, ΔH and ΔS.
5. Differentiate between thermal and photochemical processes.
6. Identify reasons for high and low quantumyield.
7. Draw Jablonski diagram for qualitative description of fluorescence and phosphorescence.

Reference Books:

1. Physical Chemistry by G. M. Barrow, International student Edition, McGrawHill.
2. University General Chemistry by C.N.R. Rao,Macmillan.
3. Physical Chemistry by, R. A. Alberty, Wiley EasternLtd.
4. The Elements of Physical Chemistry by P. W. Atkins,Oxford.
5. Principles of Physical Chemistry by S. H. Maron, C. H. Prutton, 4thEdition.
6. Fundamentals of Photochemistry by K.K.Rohatgi-Mukerjee.
7. Principles of Physical Chemistry by Puri, Sharma, Pathania, Shobhanlal Nagin chand and Company,Jalandar.
8. Text Book of Physical Chemistry by S. Glasstone, Macmillan IndiaLtd.
9. Elements of Physical Chemistry by D. Lewis and S. Glassture (Macmillan).
10. Principles of Physical Chemistry by Maron and Lando (Amerind).
11. An Introduction to Electrochemistry by S.Glasstone.
12. Physical Chemistry by W. J.Moore.
13. Essentials of Physical Chemistry, Bahl and Tuli (S.Chand).
14. Quantum Chemistry: R. K. Prasad
15. Quantum Chemistry: D. A. Mac Querrey

PAPER –X: DSE-2A

CHEMISTRY-X (2231512)

Title: INORGANIC CHEMISTRY

Total Credits: 3 Marks: 100
Contact hrs: 36

Learning objective:

1. To learn the basics of crystal field theory and molecular orbital theory
2. To understand the applications of inorganic polymers
3. To learn about functioning of Metalloporphyrins
4. To aware about role of nutrient functioning in plant growth.

Unit 1: Metal Ligand Bonding inTransition Metal Complexes: 14

A) Crystal Field Theory (CFT).

1.1 Introduction-

1.2 Formation of complexes with Crystal field splitting of 'd' orbitals

i. Shapes of *d* orbitals and their electron density region

ii.Formation of octahedral complex with crystal field splitting of 'd' orbitals, e.g.high spin and low spin octahedral complexes of Co(III):$[CoF_6]^{3-}$, $[Co(NH_3)_6]^{3+}$.

iii. Formation of tetrahedral Complex with Crystal field splitting of 'd' orbitals, e.g.$[CoCl_4]^{2-}$

iv. Formation of square planer Complex with Crystal field splitting of 'd'orbitals e.g.$[Co(CN)_4]^{2-}$

1.3 Jahn–Tellar distortion.

1.4 Factors affecting the Crystal – field splitting.

1.5 Crystal field stabilization energy (Δ) and its Calculation for octahedral and tetrahedral complexes.

1.6 Applications and limitations of CFT.

B) Molecular Orbital Theory (MOT).

1.7 Introduction.

1.8 Symmetry classesof atomic orbitals

1.9 Formation of octahedral complex a) Assumptions b) M.O.energy level diagram for Hypothetical octahedral complex.

Examples: octahedral complexes with sigma bonding only such as-

e.g.$[Ti(H_2O)_6]^{3+}$, $[FeF_6]^{3-}$, $[Fe(CN)_6]^{3-}$, $[CoF_6]^{3-}$, $[Co(NH_3)_6]^{3+}$, $[Ni(NH_3)_6]^{2+}$

1.10 Applications and limitations of MOT.

1.11 Comparison between CFT and MOT.

Unit 2: Inorganic Polymers **08**

2.1 Introduction

2.2 Basic concepts and definition

2.3 Classification of polymers organic and inorganic polymers

2.4 Comparison between organic and inorganic polymers

2.5 Polymer back bone

2.6 Homoatomic polymer containing

i) Phosphorous

ii) Fluorocarbons

2.7 Heteroatomic polymers

i) Silicones

ii) Phosphonitrilic compounds

Unit 3: Bioinorganic Chemistry **08**

3.1 Essential and trace elements in biological process.

i) Essential elements a) Macro/major elements b) Micro/trace/minor elements

ii) Non-essential elements

3.2 Metalloporphyrins with special reference to haemoglobin and myoglobin.

iii) Structure of Haemoglobin (Hb)

iv) Structure of Myoglobin (Mb)

v) Function of Haemoglobin (Hb) and Myoglobin (Mb) as Oxygen transport from lungs to tissues

vi) Function of Haemoglobinas Carry back CO_2 to lungs

vii) Co-operativity

viii) Oxygen binding curve

ix) Difference between Haemoglobin (Hb) and Myoglobin (Mb)

Role of alkali and alkaline earth metal ions with special reference to Na^+, $K^+$and Ca^{2+}.

i. Role of Na^+ and K^+

ii. Role of Ca^{2+}.

Unit 4: Fertilizers **06**

4.1 Nutrient Functions in plant growth:

Nitrogen, Phosphorous, Potassium, Calcium, Magnesium, Sulphur, Boron, Iron, Zinc, Manganese, Copper, Molybdenum, Chlorine, Role of these nutrients as: Functions, Excess supply and Deficiency.

4.2 Definition and qualities of an ideal fertilizers:

4.3 **Classificationortypes of fertilizers:**

4.4 Manufacture of fertilizers, eg. Urea, Ammonium sulphate, Superphosphate, Triple superphosphate, Ammonium phosphate. Mixed fertilizers, Compound or complex fertilizers. Pollution caused by fertilizers:

Course outcome:

After successful completion of this Course student will be able to-

1. Define Jahn Teller Distortion.
2. Apply crystal field theory and molecular orbital theory to complexes.
3. Define the terms Homoatomic and Heteroatomic Polymers.
4. Explain the role of nutrient in plant growth.
5. Draw the structures of Metalloporphyrins.
6. Differentiate between haemoglobin and myoglobin.

ReferenceBooks:

1. Concise Inorganic Chemistry (ELBS,5th Edition)-J.D.Lee.
2. Inorganic Chemistry (ELBS, 3rd Edition) D. F.Shriver,P. W.Atkins,C.H.Lang Ford, Oxford University Press, 2nd Edition.
3. Inorganic Chemistry (Harper International, 3rd edition) J.E. Huheey Harper and Row.
4. Basic Inorganic Chemistry: Cotton and Wilkinson.
5. Advanced Inorganic Chemistry (4th Edn.) Cotton and Wilkinson.
6. Concepts and Models of Inorganic Chemistry: Douglas and Mc.Daniel.3rd Edition. John Wiley publication.

7. Fundamental concepts of Inorganic Chemistry by E.S.Gilreath.
8. Structural principles in inorganic compounds.W.E.Addison.
9. T.B.of Inorganic analysis-A. I.Vogel.
10. Theoretical principles of Inorganic Chemistry-G. S.Manku.
11. Theoretical Inorganic Chemistry by Dayand Selbine
12. Co-ordination compounds SFA Kettle.
13. Modern Aspects of Inorganic Chemistry.E.Sharpe.
14. New guide to ModernValence Theory by G. I.Brown.
15. Essentials of Nuclear Chemistry by H. J.Arnikar.
16. Organometallic Chemistry by R.C.Mahrotra A.Sing,Wiley Eastern Ltd.New Delhi.
17. Inorganic Chemistry by A. G.Sharpe, Addision-Wisley Longman-Inc.
18. Principles of Inorganic Chemistry by Puri,Sharma and Kalia,Vallabh Publication. Pitampur Delhi.
19. Text book of Inorganic Chemistry by K. N. Upadhyaya Vikas Publishing House –New Delhi.
20. Progress in inorganic polymer by Laport and Leigh.
21. Co-ordination compounds by Baselo and Pearson.
22. Advanced inorganic chemistry,Vol.I and II Satyaprakash, G.D.Tuli, S.K.Basu and Madan (S Chand)
23. Selected Topics in inorganic chemistry byW U Malic, G. D. Tuli, R.D. Madan.(S.Chand)
24. Industial chemistry part I and II by A. K.De
25. Industrial Chemistry,By–B K Sharma, Goel Publishing House 16th Edition:Topic No26, Page No.762 to 808
26. A Textbook of Polymer Science by V. K. Ahluwalia and Anuradha Mishra (Ane Books Pvt. Ltd.)

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Academic Council 5(5.2)
15th June, 2022

Paper – XI: DSE- 3A:

CHEMISTRY-XI (2231513)

Title: Organic Chemistry

Total Credits: 3 Marks: 100
Contact hrs: 36

Learning objectives:

Students should understand–

1. What is IR Spectroscopy?
2. To calculate fundamental modes of vibrations for a given molecule.
3. Which factors affect IR band position?
4. To distinguish compounds by this spectroscopic method
5. To determine structure and follow the course of reaction by IR spectrum
6. What is the principle of PMR?
7. Various terms used in PMR spectroscopy.
8. Why TMS is used as a reference compound?
9. To distinguish compounds by PMR
10. To determine structure of an organic compound from spectral data.
11. Definition and formation of intermediates
12. Possible mechanism of some known name reactions.
13. What is rearrangement reaction?
14. Different types of intermediate in rearrangement reactions?
15. To write mechanism of some named rearrangement reactions
16. Synthetic applications some reagents
17. Prediction of product/s or supply of the reagent/s for these reactions.
18. Meaning of terms Disconnection, Synthons, Synthetic equivalence, Functional Group Interconversion, Target Molecule
19. What is retrosynthesis?
20. Various steps involved in the synthesis of some molecules (detailed mechanism is not expected)

21. To promote understanding of basic facts and concepts in Chemistry while retaining the excitement of Chemistry.
22. To develop the problem solving skills of student.
23. To develop ability to acquire the knowledge of terms, facts, concepts, processes techniques and principles of subjects.

Unit I: Spectroscopic Methods

1.1. Infrared Spectroscopy **7**

1.1.1 Introduction

1.1.2 Principle of IR spectroscopy

1.1.3 Double beam IR spectrophotometer- Schematic diagram

1.1.4 Fundamental modes of vibrations

1.1.5 Types of vibrations

1.1.6 Hooke's law

1.1.7 Factors affecting values of vibrational frequencies

1.1.8 Conditions for absorption of radiation and selection rule

1.1.9 Fundamental group regions of IR spectrum

1.1.10 Functional group region, Finger print region, Aromatic region

1.1.11 Characteristic absorption of various functional groups

1.1.12 Applications of IR spectroscopy – Determination of structure, Identification of functional groups, spectral problems based on IR

1.2 NMR Spectroscopy **7**

1.2.1 Introduction

1.2.2. Proton magnetic resonance (1H) spectroscopy (PMR)

1.2.3 Principles of PMR spectroscopy

1.2.4 Magnetic and non-magnetic nuclei

1.2.5. Theory of PMR spectroscopy - spinning nuclei, magnetic moment and magnetic field, processional motion of nuclei without mathematical details, nuclear resonance

1.2.6 NMR - Instrument. Schematic diagram

1.2.7. Shielding and de-shielding effect

1.2.8. Chemical shift, measurement of chemical shift by delta scale and tauscale

1.2.9. TMS as reference. Advantages of TMS

1.2.10. Peak area (integration)

1.2.11. Spin - spin splitting (n + 1rule)

1.2.12. Definition of coupling constant (J value) of first order coupling.

1.2.13. PMR spectra of ethanol, ethyl bromide, acetaldehyde, 1, 1, 2 - tribromoethane, ethyl acetate, acetophenone, benzaldehyde, propanoic acid and benzoicacid

1.3 Mass spectroscopy **5**

1.3.1 Introduction.

1.3.2 Theory of mass spectroscopy

1.3.3 Mass spectrometer – schematic diagram

1.3.4 Formation of ions by ionization

1.3.5 Types of ions with examples.

1.3.6. Applications of mass spectroscopy.

i) Determination of molecular weight.

ii) Determination of molecular formula.

1.4 Combined Problems based on UV, IR, NMR and Mass Spectral data (supporting data to be given) **2**

Unit: 2 Organic Synthesis

2.1 Name Reactions **6**

Statement, General Reaction, Mechanism and Synthetic applications

1. Diels -Alder reaction
2. Meerwein –Pondorff-Verley reduction
3. Hofmann rearrangement
4. Wittig reaction
5. Michael reaction
6. Baeyer Villiger oxidation

2.2 Reagents **5**

2.1 Sodium borohydride: Use in reduction of aldehydes and ketones

2.2 Lithium aluminium hydride: Use in reduction of aldehydes, ketones, acids, amides and esters

2.3 Osmium tetroxide:Hydroxylation of alkenes

2.4 1,3-dithiane: Umpolung concept, reactions with alkyl halide and acyl halide

2.5 Selenium dioxide: Oxidation of carbonyl compounds and allylic oxidation

2.3 Retrosynthesis **4**

2.1 Introduction

2.3 Terms used- Target molecule (TM), Disconnection, Synthons, Synthetic equivalence, Functional group interconversion (FGI), one group disconnection (w. r. t. suitable examples).

2.4 Retrosynthetic analysis and synthesis of target molecules: acetone cyanohydrin, Cinnamaldehyde, Cyclohexene, 2-phenyl propan-2-ol, Paracetamol, Acetophenone, Crotonaldehyde, Benzylbenzoate, and Benzyl diethyl malonate.

Course outcomes:

After completion of the course the student will be able to,

1. Determine structure of organic compound from given spectral data.
2. Recall IR functional group frequency values and apply them appropriately.
3. Summarize the stepwise solution to combined spectral problems.
4. Write the mechanism of given reaction.
5. Predict the products of learned reactions.
6. Describe role of various reagents in in different Organic transformations.
7. Recall the terminologies of retro synthesis and apply them appropriately for synthesis of common organic molecules

Reference Books:

1) Organic Chemistry: D. J. Cram and G. S. Hammond, McGraw Hill book Company, New York.
2) Organic Chemistry: I. L. Finar, The English Language Book Society, London.
3) A Guide Book to mechanism in Organic Chemistry: Peter Sykes, Longman Green and Co. Ltd. London 6thEdition.
4) Organic Chemistry: R. T. Morrison and R. N. Boyd, Prentice Hall of India Private Limited, New Delhi. 6thEdition.
5) Text book of organic Chemistry: L. N. Ferguson, N. D. Van Nostrand Company Indian Edition, Affiliated East west press private Ltd. New Delhi.
6) Organic Chemistry Vol. I, II and III: S. M. Mukharji, S. P. Singh, R. P. Kapoor Wiley Eastern, Limited, New Delhi.
7) A text book of organic Chemistry: K. S. Tewari, S. N. Mehrotra, N.K. Vishnoi Vikas Publishing House Private Ltd. New Delhi.

8) A text book of Organic Chemistry: Arun Bahl and B. S. Bahl, S.Chand and Company Ltd. 6th Edition.
9) Reaction Mechanism and Reagents in Organic Chemistry: G. R. Chatwal, Himalaya Publishing House, New Delhi.
10) Organic Chemistry Volume I and II: I. L. Finar ELBS with Longman 6th Edition.
11) Organic Chemistry Volume I and II: William Kemp, ELBS with Mc. Million 3rdEdition.
12) Advanced Organic Chemistry: Jerry March, Wiley EasternLtd.
13) Spectroscopy of Organic compounds: P. S.Kalsi
14) Organic Synthesis; The Disconnection Approach second Edition: Stuart Warren and Paul Wyatt
15) Designing Organic Syntheses: Stuart Warren

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PAPER-XII: DSE-4A (I)
CHEMISTRY-XII (2231514)

Title: ANALYTICAL AND INDUSTRIAL PHYSICAL CHEMISTRY

Total Credits: 3 Marks: 100
Contact hrs: 36

Learning objective:

1. To study the Wheatstone bridge principle by using Conductometeric titration.
2. To understand the Lambert Beer's law and apply for the determination of unknown concentration.
3. To learn potentiometric titration for determining the equivalence point graphically.
4. To know about the electroplatingtechniques on various metals.
5. To understand flame photometry for the detection of element present.
6. To know about the Atomic absorption Spectroscopy.

Unit 1: Colorimetry. **6**

1.1 Introduction

1.2 General discussion of theory of colorimetry: Lambert law, Beer's law (Derivation not expected), Terms used in Colorimetry, Application of Beer's law, Deviation from Beer's law.

1.3 Classification of methods of color measurement or comparison, Photoelectric photometer method - single cell photo-electric colorimeter.

Unit 2: Potentiometry **6**

2.1 Introduction.

2.2 Detail study of calomel, quinhydrone and glass electrodes and their use in determination of pH.

2.3 Basic circuit diagram of direct reading potentiometer

2.4 Potentiometric titrations: Classical and analytical methods for locating endpoints,

i) Acid – Base titrations.

ii) Redox - titrations.

iii) Precipitation titrations.

2.5 Advantages of potentiometric titrations.

Unit 3: Electroplating **7**

3.1 Introduction.

3.2 Electrolysis, Faraday's laws, Cathode current efficiency.

3.3 Basic principles of electroplating, cleaning of articles.

3.4 Electroplating of Nickel and Chromium.

3.5 Anodising.

Unit 4: Flame photometry **6**

4.1 Generalprinciples.

4.2 Instrumentation: Block diagram,

Burners: Total consumption burner, premix or laminar-flow burner and Lundergraph burner, Mirrors, Slits, Monochromators, Filters, Detectors.

4.3 Applications in qualitative and quantitative analysis.

4.4 Limitations of flame photometry.

Unit 5: Atomic Absorption Spectroscopy **6**

5.1 Introduction

5.2 Principle

5.3 Difference between atomic absorption spectroscopy and flame emission spectroscopy.

5.4 Advantages of atomic absorption spectroscopy over emission flame spectroscopy, Disadvantages of atomic absorption spectroscopy,

5.5 Instrumentation of single beam atomic absorption spectrophotometer

5.6 Measurement of atomic absorption spectroscopy.

5.7 Detection limit and sensitivity, Interferences, Absorption and emission profile.

5.8 Application of atomic absorption spectroscopy.

Unit 6: Conductometry **5**

6.1 Basic circuit of D.C. Wheatstone Bridge, Measurement of conductance by Wheatstone bridge, use of alternating current, conductivity water, Different types of conductivity cells, cell constant and its determination. Experimental determination of specific, equivalent and molar conductance.

6.2 Conductometric acid-base titrations

i. Strong acid against strongbase

ii. Strong acid against weak base

iii. Weak acid against strongbase.

iv. Weak acid against weakbase.

6.3 Advantages of Conductometric titrations

Course outcome:

After successful completion of this Course student will be able to-

1. Define different terms in colorimetry such as radiant power, transmittance, absorbance, molar, Lamberts Law, Beer's Law, molar absorptivity
2. Apply colorimetric methods of analysis to real problem in analytical laboratory.
3. Explain construction and working of colorimeter.
4. Explain Wheatstone bridge principle for conductometric titrations.
5. Differentiate the nature of graphs by potentiometric titration.
6. Develop the electroplating techniques for the metals.
7. Determine the element present in flame photometry.
8. Classify the qualitative and quantitative nature of element present in flame photometry.
9. Apply the electroplating equipment for the deposition of metals.
10. Detection of element by Atomic absorption spectroscopy.

Reference Books:

1. Text book of Quantitative Inorganic Analysis - By A. I. Vogel (ELBS and Longman 3rd Edition).
2. Instrumental methods of Chemical analysis by Willard, Merit and Dean.
3. Instrumental methods of Chemical analysis by Chatwal and Anand (Himalaya Publication).

4. Principles of electroplating and eletroforming by Blum and Hogaboom, Mac Graw - Hill Book Co. 3rd Edn.
5. Vogel's text book of Quantitative Inorganic Analysis by Basssett and Denny etc. ELBS and Longman 4th Edition.
6. Principles of Physical Chemistry by Puri, Sharma, Pathania, Shobhanlal Nagin chand and Company, Jalandar.
7. Text Book of Physical Chemistry by S. Glasstone, Mc Millan India Ltd.
8. Elements of Physical Chemistry by D. Lewis and S. Glasstone (Mc Millan).
9. Principles of Physical Chemistry by Maron and Lando (Amerind).
10. An Introduction to Electrochemistry by S.Glasstone.
11. Physical Chemistry by W. J.Moore.
12. Essentials of Physical Chemistry, Bahl and Tuli (S.Chand).

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PAPER-XII: DSE-4A(II)

CHEMISTRY-XII (2231515)

Title: METHODOLOGY AND MATERIALS OF INDUSTRIAL IMPORTANCE

Total Credits: 3 Marks: 100
Contact hrs: 36

Learning Objective:

1. To learn Scientific method and design of experiments..
2. To understandbasic aspects of multiple linear regression analysis.
3. To know theSafe storage and use of hazardous chemicals,.
4. To learn nanomaterial preparations.
5. To understand applications of composite materials.

Unit 1: DataAnalysis **8**

1.1 The Investigative Approach: Making and Recording Measurements. SI Units and their use. Scientific method and design ofexperiments.

1.2 Analysis and Presentation of Data: Descriptive statistics. Choosing and using statisticaltests.

1.3 Chemometrics, Analysis of variance (ANOVA), Correlation and regression, Curvefitting, fitting of linear equations, simple linear cases, weighted linear case, analysis ofresiduals,

1.4 General polynomial fitting, linearizing transformations, exponential function fit, ‘r’ and its abuse.

1.5 Basic aspects of multiple linear regression analysis.

Unit 2: Chemical Safety and Ethical Handling of Chemicals: 8

2.1 Safe working procedure and protective environment, protective apparel, emergency procedure and first aid, laboratoryventilation.

2.2 Safe storage and use of hazardouschemicals,

2.3 Procedure for working with substances that pose hazards, flammable or explosivehazards,

2.4 Procedures for working with gases at pressures above or below atmospheric – safe storage and disposal of waste chemicals, recovery, recycling and reuse of laboratorychemicals,

2.5 Procedure for laboratory disposal of explosives, identification, verification and segregation of laboratory waste, disposal of chemicals in the sanitary sewer system.

2.6 Incineration and transportation of hazardouschemicals.

Unit 3: Nanomaterials 10

3.1 Overview of nanostructures and nanomaterials:classification.

3.2 Preparation of gold and silver metallic nanoparticles, self-assembled nanostructures-control of nanoarchitecture-one dimensional control.

3.3 Carbon nanotubes and inorganicnanowires.

3.4 Bio-inorganic nanomaterials, DNA and nanomaterials, natural and antisical nanomaterials,

3.5 Bionanocomposites.

Unit 4:Composite materials 10

4.1 Introduction, limitations of conventional engineering materials, role of matrix in composites,

4.2 Classification, matrix materials, reinforcements, metal-matrix composites, polymer-matrix composites, fibre-reinforced composites.

4.3 Environmental effects oncomposites.

4.4 Applications ofcomposites.

Course Outcome:

After successful completion of this Course student will be able to-

1. Analyze and presentation of data.
2. Identify explosive and hazardous chemical waste.
3. Create preparation of gold and silver metallic nanoparticles, self-assembled nanostructures.
4. ClassifyBio-inorganic nanomaterials, DNA and nanomaterials.
5. Explain Carbon nanotubes and inorganic nanowires.

6. Explain role of matrix in composites.
7. Apply environmental effects on composites.

Reference Books

1) Practical skills in chemistry, Dean, J. R., Jones, A. M., Holmes, D., Reed, R., Weyers, J. & Jones,
A. (2011) 2nd Ed. Prentice-Hall, Harlow.

2) Data analysis for chemistry, Hibbert, D. B. & Gooding, J. J. (2006) Oxford university press.

3) Errors of observation and their treatment, Topping, J. (1984).Fourth Ed., Chapman Hall, London.

4) Quantitative chemical analysis, Harris, D. C. 6th Ed., Freeman (2007) Chapters 3-5.

5) How to use Excel in analytical chemistry and in general scientific data Analysis, Levie, R. de, Cambridge Univ. Press (2001) 487 pages.

6) Chemical safety matters – IUPAC – IPCS, Cambridge University Press, 1992.

7) Inorganic Solids: An introduction to concepts in solid-state structural Chemistry, Adam, D.M. John Wiley & Sons, 1974.

8) Introduction to Nanotechnology, Poole, C.P. & Owens, F.J. John Wiley & Sons, 2003.

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Skill Enhancement course SEC -3

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Computer Applications in Chemistry (2231516)

Credit: 02 **Marks: 50**

Periods: 45

Computer Applications in Chemistry

Objective: To train the students for using advanced Chemistry related soft wares

Unit I: Use of Software: **10**

Introduction to Chemdraw, Installation, Introduction to various tabs of software, Use of Chemdraw and Chemsketch for drawing the structures, reactions and their mechanism, elemental (CHN) analysis, determination of molecular mass, IUPAC name and prediction of spectral data NMR and MASS

Unit II: Use of Excel in Chemistry: **05**

a) Functions and formulas: Sum, mean, average, power etc. Understanding formulae's, the cell and the formula bar, the formula in action, copying formulas, copying and pasting a formula and complex formula.

b) Excel chart and data analysis:

Visual representation of the data through excel graph, plotting and X-Y data set, create calibration curve, format the view graph, add trend line, equation of line and R-square value, determine the slope of a line, scale adjustment, examples, renaming the chart and worksheet, common charting errors, add a chart title.

Unit III: Use of Origin in Chemistry: **05**

Introduction to origin, software installation, introduction to various tabs of software. The origin workspace, Multi-sheet workbooks, importing data from different formats (txt, xls etc.) to origin workspace, Basic data manipulation, Creating and customizing graphs, Drawing of various types of graphs, understanding of scale, Basic data analysis, Publishing graphs.

Practical's **30**

i) Draw the structures of simple aliphatic, aromatic and heterocyclic compounds

ii) Derive chemical structure from its name and vice versa and its chemical analyses

iii) Predict the H^1NMR and C^{13}-NMR Signals for a unknown organic compounds

iv) Draw the organic reactions and their mechanism in Chemdraw

v) Draw the distillation assembly and other scientific tools diagram with Chemdraw

vii) Draw bar graph, give legends, chart titles, axis title and error bar in Excel

viii) Draw scattered and linear graph for given data in Excel.

ix) Import and plot the given data with legends in Origin

x) Stack plotting in Origin

xi) Calculation of Full Width at half maxima for a scientific data

xii) Calculation of particle size through origin by supplying scientific data.

xiii) Plotting on normal scale and log scale with comparison

Course Outcome: Students will be trained in

1. Drawing the structures, reactions and their stepwise mechanism through Chemdraw
2. Predicting H^1-NMR and C^{13}-NMR spectra of unknown compounds through Chemdraw software
3. Performing analysis (Molecular weight, elemental analysis, empirical formula) along with physical properties such as m.p / b.p
4. Correctly predicting IUPAC Nomenclature
5. processing the analytical data of Chemistry in excel.
6. Plotting the experimental data of chemistry practical in Origin software.
7. Importing the numerical data through various formats and exporting the plots in PNG, JPG, JPEG, Bitmap, Tiff etc.

Reference Books (Organic Chemistry)

1. Organic Chemistry: S.M. Mukherji, S.P. Singh and R.P. Kapoor (Vol – II & III)
2. A Text book of Organic Chemistry: P.L. Soni and H.M. Chawla.
3. Elementary Organic Absorption Spectroscopy: Y.R. Sharma.
4. Reactions, rearrangements and reagents: S.N. Sanyal.
5. Principles of Physical Chemistry by Puri, Sharam and Pathania (Vishal Publication Jallandher, Delhi).
6. Advanced Physical Chemistry by Gurdeep Raj. (Goel publishing house, Meerut).
7. Principles of Inorganic Chemistry by Puri – Sharma and Kalia.
8. Chem draw, Chem Sketch and Origin Software.

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SEMESTER-VI

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PAPER-XIII: DSE-1B

CHEMISTRY-XIII (2231611)

Title: PHYSICAL CHEMISTRY

Total Credits: 3 Marks: 100
Contact hrs:36

Learning Objective:

1. To learn spectroscopic diatomic molecules for determination of force constant.
2. To understand classical theory of Raman effect and quantum theory of Raman effect.
3. To know the ideal and non-ideal solutions and study vapour pressure and boiling point diagrams of miscible liquids.
4. To derive Clapeyron-Clausius equation and solve the numerical.
5. To understand collision and Transition state theory of bimolecular reactions.

Unit1: Spectroscopy. **11**

1.1 Introduction

1.2 Electromagnetic radiation.

1.3 Electromagnetic spectrum, Energy leveldiagram.

1.4 Rotational spectra of diatomic molecules: Rigid rotor model; moment of inertia (derivation not expected); energy levels of rigid rotor, selection rule; spectral intensity; distribution using population distribution (Maxwell - Boltzmann distribution), determination of bond length; isotope effect. Interaction of radiation with rotating molecule.

1.5 Vibrational spectra of diatomic molecules: Simple Harmonic oscillator model,Vibrational energies of diatomic molecules, Determination of force constant,zero point energy. The anharmonic oscillator, overtones and hot band. Interaction of radiation with vibrating molecules.

1.6 Raman spectroscopy: Introduction, Rayleigh scattering. Raman Scattering, Classicaltheory of Raman effect and quantum theories of Raman effect. Polarization of light and the Raman effect. Mutual exclusion principle.

1.7 Numerical problems.

Unit 2: Solutions. **8**

2.1 Introduction

2.2 Ideal solutions, Raoult's law, vapour pressure of ideal and non ideal solutions of miscible liquids.

2.3 Vapour pressure and boiling point diagrams of miscibleliquids.

Type I: Systems with intermediate total vapour pressure.(i.e. System in which B.P. increases regularly - Zeotropic)

Type II: Systems with a maximum in the total vapour pressure.(i.e. System with a B.P. minimum - Azeotropic)

Type III:Systems with a minimum in the total vapour pressure.(i.e. System with a B.P. Maximum - Azeotropic)

Distillation of miscible liquid pairs.

2.4 Solubility of partially miscible liquids.

(i) Maximum solution temperature type: Phenol – watersystem.

(ii) Minimum solution temperature type:Triethyl amine – watersystem.

(iii) Maximum and minimum solution temperature type: Nicotine – watersystem.

Unit3: Thermodynamics. 10

3.1 Introduction

3.2 Free energy: Gibbs function (G) and Helmholtz function (A), Criteria forthermodynamic equilibrium andspontaneity.

3.3 Relation between G and H: Gibbs Helmholtzequation.

3.4 Phase equilibria:Clapeyron – Clausius equation.

3.5 Thermodynamic derivation of law of mass action, van't Hoff isotherm and isochore.

3.6 Fugacity and activityconcepts.

3.7 Numericalproblems.

Unit 4: Chemical Kinetics 7

4.1 Introduction, simultaneous reactions such as opposing reactions, side reactions, consecutive reactions and chain reactions. [Derivations of rate Equations for these reactionsare notexpected.]

4.2 Effect of temperature on the rate ofreaction.

1. Temperaturecoefficient
2. Arrheniusequation
3. Energy ofactivation

4.3 Theories of reaction rate:

1. Collision theoryand
2. Transition statetheory

4.4 Third order reaction with equal concentration of all reactants, their characteristics and examples

4.5 Numericalproblems.

Course Outcome:

After successful completion of this Course student will be able to-

1. Apply selection rule of rotational spectra for diatomic molecules.
2. Determine bond length of diatomic molecule.
3. Determine force constant of vibrational diatomic molecules.
4. Solve numerical on spectroscopy.
5. Explain azeotropic and zeotropic of binary liquid mixture graphically.
6. Elaborate maximum and minimum partially miscible liquid pairs.
7. Distinguish criteria of thermodynamic spontaneity.
8. Derive law of mass action, Van't Hoff isotherm and isochore.
9. Derivation of Arrhenius equation and evaluation of energy of activation graphically.
10. Derivations of collision theory and transition state theory of bimolecular reaction and comparison.
11. Solve the problem based on third order equations.

Reference Books:

1. Principles of Physical Chemistry by Maron and Pruton4thedition.
2. Principles of Physical Chemistry by Puri, Sharma, Pathania, Shobhanlal Nagin chand and Company,Jalandar.
3. Text Book of Physical Chemistry by S. Glasstone, McMillan IndiaLtd.
4. Elements of Physical Chemistry by D. Lewis and S. Glasstone (McMillan).
5. Principles of Physical Chemistry by Maron and Lando (Amerind).
6. Thermodynamics for chemists by S.Glasstone.
7. Physical Chemistry by W. J.Moore.
8. Essentials of Physical Chemistry, Bahl and Tuli (S.Chand).
9. Basic Chemical Thermodynamics by V V Rao (McMillan)
10. An introduction to chemical thermodynamics by R. R. Mishra and R. P.Rastogi.
11. Fundamentals of molecular spectroscopy by C. N. Banwell and McCash- Tata McGrawHill

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15th June, 2022

PAPER-XIV: DSE-2B
CHEMISTRY-XIV (2231612)

Title: INORGANIC CHEMISTRY

Total Credits: 3 Marks: 100
Contact hrs: 36

Learning objective:

1. To learn the basics such as electronic configuration an separation techniques of f-block elements
2. To understand the mechanism of SN^1 and SN^2 reaction of complexes.
3. To learn about different structures of carbon allotropes.
4. To aware about the nature of bonding in metal carbonyls.

Unit 1: Study of *f*-block Elements **08**

Lanthanides:-

I) Introduction
II) Electronic configuration
III) Occurrence
IV) Separationof Lanthanides
i) Bulkseparation methods
ii) Individualseparationoflanthanides-Mention names of methods only (Ion exchange method indetail)

Actinides:-

I) Introduction
II) Electronic configuration
III) GeneralMethodsofpreparation–
a. Neutron-capturefollowed by β-decay
b. Acceleratedprojectilebombardment method
c. Heavy-ionbombardment method

Unit 2: Inorganic Reaction mechanism **08**

2.1 Introduction.
2.2 Classification of Mechanism: Association, dissociation, interchange and the rate determining steps.
2.3 $SN^1$and SN^2reactions for inert and labile complexes.
2.4 Mechanism of substitution in cobalt (III) octahedral complexes.
2.5 Trans effect and its theories.
2.6 Applications of trans effect in synthesis of Pt (II) complexes.

Unit 3: Metals, Semiconductors and Superconductors **08**

3.1 Introduction.

3.2 Propertiesofmetallic solids.

3.3 Theories ofbondingin metal.

a) Freeelectron theory.

b) Molecularorbitaltheory(Band theory).

3.4 Classification of solids as conductor, insulators and semiconductors on the basis of band theory.

Semiconductors:

a) Typesofsemiconductors-intrinsicandextrinsic semiconductors.

b) Applicationsof semiconductors.

Superconductors:

a) Ceramic superconductors - Preparation and structures of mixed oxide$YBa_2Cu_3O_{7-x}$

b) Applications of superconductors.

Unit 4: Structural Chemistry. **06**

Structural study of following compounds.

i) Diborane.

ii) Borazine.

iii) Carbides: Aluminium Carbide (Al_4C_3) and Calcium Carbide (CaC_2)

iv) Diamond and Graphite and introduction to allotropes of Carbon (Fullerene, Graphene, MWCNTs)

v) Oxides of Sulphur: SO_2 and SO_3

vi) Oxides of Phosphorous: P_4O_6 and P_4O_{10}

Unit 5: Organometallic Chemistry. **06**

5.1 Introduction-Definition, Nomenclature of organometallic compounds.

5.2 Synthesis and structural study of alkyl and aryl compounds of Li, Be and Al.

5.3 Mononuclear carbonyl and nature of bonding in simple mononuclear metal carbonyls:$[Ni(CO)_4]$, $[Fe(CO)_5]$, $[Cr(CO)_6]$, $[Mn(CO)_5]$

Course outcome:

After studying the Course students will be able to-

1. Predict the difference between valence and conduction band.

2. Apply SN1 and SN2 reactions to appropriate complexes.

3. Define the trans effect in complexes.

4. Explain the various methods for the synthesis of trans uranic elements.

5. Draw the structures of allotropes of carbon

6. Draw the structures of carbides, borazine and diborane.

7. Differentiate between metals, semiconductors and super conductors.

8. Discuss the Band theory.
9. Classify between intrinsic and extrinsic semiconductors.

ReferenceBooks:

1. Concise Inorganic Chemistry (ELBS,5th Edition)-J.D.Lee.
2. Inorganic Chemistry (ELBS, 3rdEdition) D.F.Shriver, P.W. Atkins,C.H.Lang Ford, Oxford University Press, 2nd Edition.
3. Inorganic Chemistry (Harper International,3rd edition) J.E.Huheey Harper and Row.
4. Basic Inorganic Chemistry: Cotton and Wilkinson.
5. Advanced Inorganic Chemistry (4thEdn.) Cotton and Wilkinson.
6. Concepts and Models of Inorganic Chemistry: Douglas and Mc. Daniel. 3rd Edition. John Wiley publication.
7. Fundamental concepts of Inorganic Chemistry by E.S.Gilreath.
8. Structural principles in inorganic compounds.W.E.Addison.
9. T.B.ofInorganic analysis -A. I.Vogel.
10. Theoretical principles of Inorganic Chemistry-G. S.Manku.
11. Theoretical Inorganic Chemistry by Day and Selbine.
12. Co-ordination compounds SFA Kettle.
13. Modern Aspects of Inorganic Chemistry.E.Sharpe.
14. New guide to Modern Valence Theory by G. I.Brown.
15. Essentialsof Nuclear Chemistry by H. J.Arnikar.
16. Organometallic Chemistry by R. C.Mahrotra A.Sing, Wiley Eastern Ltd.New Delhi.
17. Inorganic Chemistry by A. G.Sharpe, Addision-Wisley Longman-Inc.
18. Principles of Inorganic Chemistry by Puri, Sharma and Kalia,Vallabh Publication. Pitampur Delhi.
19. Textbook of Inorganic Chemistry by K.N.Upadhyaya Vikas Publishing House– New Delhi.
20. Progress in inorganic polymer by Laport and Leigh.
21. Co-ordination compounds by Baselo and Pearson.
22. Organometallic Chemistry by P.L.Pauson.
23. Advanced inorganic chemistry,Vol.I and II Satyaprakash,G.D.Tuli,S.K.Basu and Madan

24. Selected Topics ininorganic chemistry by W U Malik, G.D. Tuli, R.D.Madan.(S.Chand)
25. Industrial chemistry part I and II by A. K.De
26. Industrial chemistry by B. K.Sharma

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Paper - XV: DSE-3B

CHEMISTRY-XV (2231613)

Title: Organic Chemistry

Total Credits: 3 Marks:100
Contact hrs: 36

Learning objectives:

Students should understand,

1. To draw different types of di substituted cyclohexane in Chair form
2. To distinguish between axial and equatorial chair forms of mono substituted cyclohexane.
3. Stability, energy calculations with potential energy diagram and optical activity of these conformers.
4. To explain classification of heterocyclic compounds synthesis and reactions of heterocyclic compounds like pyrrole, pyridine and quinoline.
5. Draw different conformations of cyclohexane
6. Describe conformational analysis of cyclohexane.
7. Differentiate stereo selective and stereospecific reactions.
8. Draw structures of carbohydrates like glucose, fructose, maltose, lactose, sucrose, starch and cellulose.
9. Determine absolute confirmation of glucose.
10. Write inter conversion of glucose and fructose.
11. Describe synthetic routes to various synthetic dyes. Explain witt's theory of colour and constitution.
12. To develop proper aptitude towards the subjects.

13. To expose and to develop interest in the fields of chemistry.
14. To expose students to various emerging new areas of Chemistry and apprise them with their prevalent in their future studies and their applications in various spheres of chemical sciences.
15. To inquire of new knowledge of chemistry and developments therein.

Unit: I

1. Heterocyclic compounds **7**

1.1 Introduction and classification

1.2 Pyrrole

1.2.1 Methods of synthesis: i) From acetylene ii) From furan iii) From succinamide

1.2.2 Physical properties

1.2.3 Reactivity of pyrrole: i) Basic character ii) Acidic character iii) Electrophilic substitution with general mechanism

1.2.4 Chemical reactions: i) Reduction ii) Oxidation iii) Nitration iv) Sulphonation v) Halogenation vi) Friedel Craft's reaction vii) Coupling reaction

1.3 Pyridine

1.3.1 Methods of synthesis: i) From acetylene and hydrogen cyanide ii) From piperidine

1.3.2 Physical properties

1.3.3 Chemical reactions: i) Basic character ii) Electrophilic substitution reactions: Nitration, Sulphonation and Bromination iii) Nucleophilic substitution - General mechanism, Reactions with sodamide, sodium hydroxide and n-Butyllithium

1.4 Quinoline

1.4.1 Synthesis - Skraup's synthesis

1.4.2 Physical properties.

1.4.3 Reactions of quinoline: i) Electrophilic substitution reactions - Nitration and sulphonation

ii) Nucleophilic substitution reactions – Reactions with sodamide, alkyl lithium and aryllithium

iii) Reduction

2. Stereochemistry **7**

2.1 Introduction.

2.2 Baeyer's strain theory.

2.3 Theory of strainless rings.

2.4 Conformation and stability of cyclohexane and monosubstitutedcyclohexanes: methylcyclohexane.

2.5 Locking of conformation in t-butylcyclohexane.

2.6 Stereoselective and stereospecific reactions:

i) Stereochemistry of addition of halogens to alkenes: syn and anti-addition. Example- Addition of bromine to 2-butene. (mechanism of expected)

3. Organic synthesis via Enolates **6**

3.1 Introduction - Reactive methylene group.

3.2 Ethyl acetoacetate - synthesis by Claisen condensation, acidity of methylene hydrogen (salt formation), Keto-enoltautomerism, synthetic applications - Synthesis of alkyl and dialkyl derivatives, monobasic, dibasic and α- β- unsaturated acid, heterocyclic compound.

Unit: II

1. Carbohydrates **9**

1.1 Introduction

1.2 Classification and nomenclature

1.3 Monosaccharide D-glucose - Open chain structure

1.4 Chain lengthening of Aldoses –Kiliani synthesis

1.5 Chain shortening of Aldoses - Weerman's reaction

1.6 Interconversion of glucose and fructose

1.7 Configuration of D-glucose from D-arabinose

1.8 Objections against open chain structure of D-glucose.

1.9 Mutarotation with mechanism.

1.10 Ring structure of D-glucose - Determination of size of ring by Methylation method.

1.11 Disaccharides - Introduction, sucrose and lactose - sources, structural formulae and uses.

1.12 Polysaccharides–Introduction, Starch and Cellulose - sources, structural formulae and uses

2. Synthetic dyes **7**

2.1 Introduction, Classification, Qualities of good dye

2.2 Witt's theory - Colour and constitution

2.3 Synthesis of Orange IV, Malechite green, phenolphthalein

Course outcomes:

After learning this course students will be able to,

1. Explain classification of heterocyclic compounds synthesis and reactions of heterocyclic compounds like pyrrole, pyridine and quinoline.
2. Draw different conformations of cyclohexane
3. Describe conformational analysis of cyclohexane.
4. Differentiate stereoselective and stereospecific reactions.
5. Draw structures of carbohydrates like glucose, fructose, maltose, lactose, sucrose, starch and cellulose.
6. Explain confirmation of glucose.
7. Write inter conversion of glucose and fructose.
8. Describe synthetic routes to various synthetic dyes. Explain witt's theory of colour and constitution.

Reference Books:

1) Organic Chemistry - Cram D. J. and Hammond G.S. McGraw Hill book Company New York.
2) Organic Chemistry - Finar I. L. The English Language Book Society, London.
3) A Guide Book to mechanism in Organic Chemistry - Peter Sykes Longman Green and Co. Ltd. London 6th Edition.
4) Organic Chemistry - R. T. Morrison and R. N. Boyd Prentice Hall of India private limited New Delhi. 6thEdition.
5) Text book of organic Chemistry - Ferguson L. N. D. Van Nostrand Company Indian Edition, Affiliated East West press private Ltd. New Delhi.
6) Organic Chemistry Vol. I, II and III - S. M. Mukharji, S. P. Singh, R. P. Kapoor Wiley Estern, Limited, New Delhi.
7) A text book of organic Chemistry - K. S. Tewari, S. N. Mehrotra, N. K. Vishnoi Vikas Publishing House Private Ltd. New Delhi.
8) A text book of Organic Chemistry – Arun Bahl and B. S. Bahl S. Chand and Company Ltd. 6thEdition.
9) Heterocyclic Chemistry Synthesis, Reactions and Mechanism - Raj K. Bansal Wiley Easter Ltd. New Delhi.

10) Reaction Mechanism and reagents in Organic Chemistry - G. R. Chatwal Himalaya Publishing House New Delhi.
11) Organic Chemistry Volume I and II - I. L. Finar ELBS with Longman 6th Edition.
12) Organic Chemistry Volume I and II - William Kemp ELBS with Macmillion 3rd Edition.
13) Advanced Organic Chemistry - Jerry March Wiley Eastern Ltd.
14) Organic Chemistry – Fieser and Fieser.
15) Principles of Organic Chemistry - English and Cassidy.
16) Principles of Organic Chemistry - M. K. Jain.
17) Organic Chemistry by Clayden, Greeves, Warren and Wothers Oxford press.
18) Organic Chemistry - A Comprehensive degree text and source book by Hanes Baeyers and Wolfgang Walter Albion Chemical Science Series.
19) Reactions, Rearrangements and reagents - S.N. Sannyl, Bharati Bhawan publishers and Distributors Patna.
20) Synthetic Organic Chemistry-Kamlesh Bansal.
21) Synthetic Organic Chemistry-Gurudeep Chatwal.
22) Chemistry of Insecticides – U.S. Sree Ramulu.
23) Medicinal Chemistry- Ashitosh Kar.

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15th June, 2022

Paper-XVI: DSE-4B(I)
CHEMISTRY-XVI (2231614)

Title: Analytical and Industrial Organic Chemistry

Total Credits: 3 Marks: 100
Contact hrs: 36

Learning objectives:

Students should

1. Understand the classification of drugs; know the qualities of ideal drug. Synthesis and uses of some representative drugs.
2. Explain the Manufacturing process of sugar and importance of byproducts of sugar industry

3. Describe various methods of classification of polymers, synthesis and applications of various polymers.
4. Discuss the need of green chemistry ii. Summarize twelve principles of green chemistry iii. Explain advantages of green chemistry iv. List simple examples to clarify the principles v. describe catalytic routes for sustainable developments and apply the knowledge of contents of principles of chemistry.
5. Categorize various agrochemicals in different types. Explain synthesis and uses of some representative agrochemicals.
6. To make students capable of studying Chemistry in academic and Industrial courses and to expose the students to different processes used in Industries and their applications.

Unit: I

1. Pharmaceuticals **9**

1.1 Introduction, classification, Qualities of ideal drug

1.2 Synthesis and uses of the following drugs:

i) Antimalerials -Paludrin

ii) Antituberculars - Isoniazide and Ethambutol

iii) C. N. S. drugs -Phenobarbitone

iv) Antidiabetics–Tolbutamide/Metformin

v) Anti-inflammatory drugs -Ibuprofen

vi) Antibiotics -Chloromycetin

vii) Anticancer drugs :Chlorambucil(Leukeran)

2 Agrochemicals **5**

2.1 General idea of agrochemicals including pyrethroides

2.2 Synthesis and uses of the following agrochemicals:

i) Indole-3-acetic acid.

ii) Monocrotophos

iii) Methoxychlor

iv) Ethophan

v) Carbaryl

vi) Baygon

3. Synthetic Polymers **8**

3.1 Introduction

3.2 Classification:

i) According to origin, composition, method of preparation and general physical properties

ii) Classification based upon structure

3.3 Process of addition polymerisation - free radical polymerisation of alkenes and Dienes

3.4 Ionic polymerisation

3.5 Ziegler – Natta polymerisation

3.6 Methods of preparation and uses of:

i) Polystyrene ii) PVC iii) Phenol formaldehyde resin iv)Polyurethane

3.7 Natural rubber: General idea and vulcanisation

3.8 Synthetic rubbers: Synthesis and uses of: i) Polychloroprene ii) Buna rubber - Buna N andBunaS

Unit: 2

1. Sugar and Alcohol Industry **6**

1.1 Manufacture of cane sugar in India: Extraction of juice, Clarification, Concentration, crystallization, centrifugation and other details of industrial process

1.2 By-products of sugar industry

1.3.1 Manufacture of ethyl alcohol from molasses

1.3.2 Rectified spirit, Denatured spirit absolute alcohol and power alcohol

1.3.3 By-products of alcohol industry

2. Green Chemistry **8**

2.1 Introduction - Twelve principles of green chemistry

2.1.1 Significance of Atom economy with suitable examples

2.2 PTC: Introduction, Role in organic reactions catalysis

2.3 Bio-catalytic reactions - Hydroxylation and oxidation using enzymes

2.4 Introduction to microwave assisted reactions

2.5 Ionic liquids – Introduction and examples of ionic liquids

Course outcomes:

Learners will be able to,

1. Classify drugs based on therapeutic use; know the qualities of ideal drug and produce synthesis and uses of some representative drugs.

2. Explain the Manufacturing process of sugar and importance of byproducts of sugar industry
3. Describe various methods of classification of polymers, synthesis and applications of various polymers.
4. Discuss the need of green chemistry ii. Summarize twelve principles of green chemistry iii. Explain advantages of green chemistry iv. List simple examples to clarify the principles v. describe catalytic routes for sustainable developments and apply the knowledge of contents of principles of chemistry.
5. Categorize various agrochemicals in different types. Explain synthesis and uses of some representative agrochemicals.

Reference Books:

1. Basic Concepts of Analytical Chemistry - S. M. Khopkar, Wiley Eastern Ltd. Bombay.
2. Industrial Chemistry - R. K. Das, Asia Publishing, Mumbai.
3. Text Book of Quantitative Organic Analysis - A. I. Vogel, Pearson Edn. Delhi.
4. Quantitative Organic Chemistry - A. I. Vogel, Pearson Edn. Delhi
5. Hand Book of Organic Analysis - H. T. Clarke, Arnold Heinemann Pub. Delhi.
6. Advanced Organic Chemistry - B. S. Bahl and Arun Bahl, S. Chand Comp. Delhi.
7. Riegel's Handbook of Industrial Chemistry - J. A. Kent, Van. Nostrard, Londan.
8. Chemical Process Industries - Shreve and Brinic - Ostin, Magraw Hill, NewYork.
9. Analytical Chemistry- Walton.
10. Biotechnology and Applied Microbiology - Alani and Moo-Young.
11. Immobilize Biocatalysis– Joy Wleser.
12. Introduction to Polymer Chemistry - Raymond B. Seymour.
13. Polymer Science - V. R. Gowarikar, N. V. Viswanathan and Jayadev Sreedhar Willey Eastern Limited.
14. Advances in Green Chemistry: Chemical synthesis using MW-irradiation by R. S.Varma.
15. Green Chemistry: Environment Friendly alternatives- Rashmi Sanghiand M. M. Srivastava (Eds) (c) 2003 Narosa Publishing House, New Delhi, India.
16. Reactions, rearrangements and reagents : S. N.Sanyal
17. Organic reaction mechanism: V. K. Ahluwalia and K. R. KParashar

18. Environment friendly synthesis using ionic liquids: JairtonDupont, Toshiyuki Itoh and Sanjay V. Malhotra (CRC Press)
19. Chemicals for crop improvement and pest management - Green, Hartly and West.
20. Chemistry of pesticides - K. H. Buchel (T.W.)
21. Medical Chemistry –Burger

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Paper-XVI: DSE-4B(II)
CHEMISTRY-XVI (2231615)
Title: Applied Organic Chemistry

Total Credits: 3 Marks:100
Contact hrs: 36

Learning objectives:

Students should understand-

1. What are the types of binary mixture and how it can separate?
2. Describe the preparation method and uses for the various cosmetics and perfumes.
3. The types of fermentation and productions antibiotics and vitamins.
4. The classification of fibers and process used in textile industries

Unit1: Theory of binary mixture analysis 05

1.1 Types of organic compounds, nature and types of binarymixtures.
1.2 Reactions of acid, base, phenol and neutrals with sodium bicarbonate, sodiumhydroxide and hydrochloricacid
1.3 Principle of binary mixtureseparation.
1.4 Determination of type of themixture
1.5 Separation of mixture- using aqueous medium andether.

Unit 2: Chemistryofcosmetics 10

2.1 A general study including preparation and uses of-Hair dye, hairspray, shampoo, suntan lotions, face powder, lipsticks, talcum powder, nail enamel, cold creams, vanishing creams and shaving creams

Unit 3: Chemistry of perfumes 10

3.1 A general study including preparation and uses of-antiperspirants, and artificial flavours
3.2 Essential oils and their importance in cosmetic industry with reference to Eugenol, geraniol, sandalwood oil, eucalyptus oil, rose oil, 2-phenyl ethyl alcohol, jasmone, civetone andmuscone

Unit 4: Fermentation 05

4.1 Aerobic and anaerobic fermentation
4.2 Production of antibiotics-streptomycin
4.3 Production of vitamins-Vit.B12

Unit 5: TextileChemistry **06**

5.1 Introduction, classification offibers
5.2 Sizing: object of sizing, sizing ingredients and theirfunctions
5.3 General idea of processes: singeing, desizing, scouring
5.4 Bleaching: Brief study of the outline of the process of bleaching cotton and synthetic material.
5.5 Dyeing: Study of dyeing of cellulosic material and synthetic fibers withdyes like direct, vat, reactive and dispersedyes.

Course outcomes:

Students will be able to-

1. Explain the types of binary mixture and how it can separate?
2. Describe the preparation method and uses for the various cosmetics and perfumes.
3. Explain the types of fermentation and productions antibiotics and vitamins.
4. Describe the classification of fibers and process used in textile industries

Reference Books:

1. Industrial chemistry: B. K. Sharma (Goel Publishing House,Meerut)
2. Engineering Chemistry: P. C. Jain and M. Jain (Dhanpatrai and sons,Delhi)
3. Practical Organic Chemistry: A. I. Vogel
4. Advances in green chemistry-Chemical synthesis using Microwaveirradiation: R. S.Verma
5. A book of textile chemistry: A. J.Hall
6. Bleaching and Dyeing: Dr. V.Shenai
7. Sizing: D. B.Ajgaonkar
8. Chemical process industries: Shreve and Brinik (Ostin Mc Graw Hill Publication, NewYork)
9. Medicinal and Pharmaceutical Chemistry: Hakishan, V. K. Kapoor (Vallabh Prakashan Pimpura New Delhi)
10. Industrial Chemistry, Vol. I:E. Stocchi (Ellis Horwood Ltd,UK)

Academic Council 5(5.2)
15th June, 2022

PRACTICALS

N.B. i. Use of Electronic balance with 0.001g accuracy is mandatory.
ii. Use of Scientific calculator is allowed.

DSE 1A &1B: Practical-IV

Physical Chemistry Practical (2231616)

Total Credits: 4 Marks:100
Contact hrs: 48

Learning Objective:

1. To acquire skill for handling instruments like potentiometer, P^H-meter, colorimeter, Refractometer etc.
2. To find out the dissociation constant, energy of activation by titrations.
3. To learn equilibrium constant by the distribution method.

I) Non instrumental Experiments (any Five):

1. To determine the equilibrium constant of the reaction, $KI + I_2 = KI_3$ by the Distribution method.
2. To determine the partition coefficient of CH_3COOH between H_2O and CCl_4.
3. Critical SolutionTemperature.
   To determine the CST for phenol – water system.
4. The study of energy of activation of first order reaction i.e. hydrolysis ofmethyl acetate in presence of 0.5NHCl.
5. The study of energy of activation of first order reaction i.e. hydrolysis ofmethyl acetate in presence of $0.5NH_2SO_4$.
6. The study of energyof activation of second order reaction i.e. reaction between $K_2S_2O_8$ and KI (Equal concentrations).
7. The study of energyof activation of second order reaction i.e. reaction between $K_2S_2O_8$ and KI (Unequal concentrations).
8. To study the hydrolysis of methyl acetate by using its two concentrations in presence of 0.5N HCl and hence find velocity constant of thereaction.
9. To study the effect of addition of electrolyte (KCl) on the reaction between $K_2S_2O_8$ and KI (Equal concentrations).

II. Instrumentalexperiments

A. Potentiometry (anyThree).

1. Titration of strong acid with strong alkali.
2. Preparation of buffer solution and determination of their pH (Any five buffer solutions), - Theoretical calculation of pH values by using Henderson's equation.
3. Determination of standard electrode potential of Zn/Zn^{++}, Cu/Cu^{++}, Ag/Ag^{+}(Anytwo).
4. Determination of solubility and solubility product of AgCl.

5. Titration of ferrous ammonium sulphate using $K_2Cr_2O_7$ solution and to calculate redox potential of Fe^{++}, Fe^{+++}system

B. Conductometry (any three).

1. Titration of weak acid with strong alkali.
2. Titration of a mixture of weak acid and strong acid with strong alkali.
3. To study the effect of substituent on dissociation constant of weak acid with respect to acetic acid and Monochloro acetic acid (cell constant to begiven).
4. To determine the velocity constant of hydrolysis of ethyl acetate by NaOH solution by Conductometric method.

C. Refractometry.

1. To determine the percentage composition of unknown mixture by (i)graphical method and (ii) by composition law (Densities of pure liquids A & B begiven).
2. To determine the molar refractivityof methyl acetate, ethyl acetate, n-hexane and carbon tetrachloride and calculate the refraction equivalents of C, H and Clatoms.

D. Colorimetry (any Two).

1. To verify Lambert - Beer's law using $CuSO_4$ solution.
2. To estimate Fe^{+++} ions by thiocynate method.
3. To estimate Fe^{+++} ions using salicylic acid by colorimetric titration.

E. pH - metry (any One).

1. To determine the dissociation constant of monobasic acid (Acetic acid).
2. To determine the dissociation constant of dibasic acid (Malonic acid).

Course Outcome:

After successful completing the Course student will able to-

1. Developed the skill for handling instruments like potentiometer, P^H-meter, colorimeter and determine dissociation constant.
2. Recall Lambert-Beer's law for $CuSO_4$ solution by colorimetrically.
3. Determine critical solution temperature by phenol-water system.
4. Determine energy of activation by various order of reactions.
5. Prepare various concentrations of buffer solutions.
6. Construct acid base titrations and determine the equivalence point graphically.
7. Calculate atomic and molar refractivity.

Reference Books:

1. Findlay's Practical Physical Chemistry(Longman).
2. Advanced Practical Physical Chemistry by J. B. Yadav, Goel publishing house.
3. Practical Physical Chemistry by B. D. Khosla, V. C. Garg (R. Chand andCo.)
4. Systematic experimental Physical Chemistry by Rajbhoj, Chandekar (Anjali Publicaiton)
5. Practical Physical Chemistry:Nandkumari, Kothari and Lavande.
6. Practical Physical Chemistry by Gurtu (S.Chand).

DSE 2A &2B: Practical –V
Inorganic Chemistry Practical (2231617)

Total Credits: 4 Marks:100
Contact hrs: 48

Learning Objective:

1. To acquire preparation, gravimetric and volumetric analyses skills.
2. To learn the percentage purity techniques.
3. To effectively understand the qualitative and quantitative analyses.
4. To learn the ion exchange separation technique
5. To aware about the exact process of determination of Hardness of any kind of water with COD and BOD

I. Gravimetric Estimations(G).

N. B.: Any two experiments from G1 to G3 and any two experiments from G4 to G7

G1. Gravimetric estimation of iron as ferric oxide from the given solution containing ferrous ammoniumsulphate, copper sulphate and free sulphuric acid.

G2. Gravimetric estimation of zinc as zinc pyrophosphate from the given solution containing zincsulphate, ferrous ammonium sulphate and free sulphuric acid.

G3. Gravimetric estimation of barium as barium sulphate from the given solution containing barium chloride, ferric chloride and free hydrochloric acid.

G4. Gravimetric estimation of manganese as manganese ammonium phosphate from the given solution containing manganese sulphate, copper sulphate and free sulphuric acid.

G5. Gravimetric estimation of barium as barium chromate from the given solution containing barium chloride, ferric chloride and free hydrochloride acid.

G6. Gravimetric estimation of Aluminium as Aluminiumoxinate i.e. tris (8-hydroxyquinolinato) aluminate (III) from a given solution containing potash alum,

coppersulphate and free sulphuric acid.

G7. Gravimetric estimation of nickel as bis (dimethylglyoximato) nickel (II) from the given solution containing nickel sulphate, ferrous ammonium sulphate and free sulphuric acid.

[For the gravimetric experiments, stock solution should be given in the range of 10 to 15 cm and asked to dilute to 100 cm (or the stock solution should be given in the range of 20 to 30 cm and asked to dilute to 250 cm). Use 50 cm of this diluted solution for estimation.]

II. Inorganic Preparations (P): (any five).

N. B.–1. Calculations of % yield is expected.

2. After preparation, physico-chemical characterization is expected with 5 (Five) marks weightage in terms of:

a) Name of central metalion

b) Oxidation number of metalion

c) Nature ofligand

d) Nature ofbonding

e) Type ofhybridization

f) Inner orbital or outer orbitalcomplex

g) Geometry of the complex withstructure

h) Magnetic property of thecompound

i) Color of thecompound

j) Nature: Crystalline /Amorphous

P1. Preparation of potassium trioxalato ferrate(III)

P2. Preparation of potassium trioxalato aluminate (III)

P3. Preparation of tris (ethylene diamine) nickel (II) thiosulphate

P4. Preparation of sodium hexanitro cobaltate (III)

P5. Preparation of ammonium diammine tetra thiocynato chromate (III) (Reineck's salt)

P6. Preparation of nickel ferrite.

P7. Preparation of hexamine nickel (II) chloride

P8. Preparation of tris (thiourea) cuprous (I) sulphate

III) Titrimetric Estimations:

A) Percentage Purity (anythree)

V1. Determination of percentage purity of ferrous ammonium sulpahte.

V2. Determination of percentage purity of tetramminecopper (II) sulphate.

V3. Determination of percentage purity of potassium trioxalatoaluminate(III).

V4. Determination of percentage purity of potassium trioxalatoferrate (III).

B) Analysis of Commercial Sample (any three).

V5. Determination of percentage of magnesium in the given sample of talcum powder.

V6. Determination of amount of aluminium in the given solution of potash alum.

V7. Determination of titrable acidity in the given sample of milk or lassi.

V8. Determination of Chemical Oxygen Demand of the given sample of industrial effluent by dichromate method.

V9. Determination of percentage purity of boric acid using supplied sodium hydroxide (Standard succinic or oxalic acid solution to be prepared for standardization of the given sodium hydroxide solution.)

C) Ion exchange method

V10. Determination of amount of sodium present in the given solution of common salt using cation exchange resin (By Acid Base titration).

V11. Determination of amount of magnesium and zinc in the given solution containing ($Mg^{++}$and Zn^{++}) using anion exchange resin and standard solution of EDTA.

Course Outcome:

After successful completing the Course student will able to-

1. Put the experiments of gravimetric analysis, remove the interfering radical and determine the accurate weight and percentage of Ba, Fe and Ni from supplied sample.
2. Recall Werner theory through preparation hexamine nickel (II) chloride complex, trioxalato aluminate (III),.
3. Determine the nature of complex salts: Inner or Outer orbital complex
4. Calculate Oxidation State, Coordination number etc.
5. Determine the purity of commercial sample of milk/talcum powder / trioxalato aluminate (III), FAS, and Boric acid.
6. Separate cations (Na^{+}, Ca^{2+}, Mg^{2+}, Zn^{2+}) and anions (Cl^{-}, SO_4^{2}-, CO_3^{2-}) by using Dowex-250 and Amberlite IR-120 respectively.
7. Determine the total hardness of any kind of hard water with their BOD and COD values in ppm.

Reference Books:

1. A text book of quantitative Inorganic Analysis - A. I.Vogel.
2. Text book of Quantitative Inorganic Analysis - Kolthoff and Sandell.
3. Experimental Inorganic Chemistry - Palmer W.G.
4. Advanced Practical Inorganic Chemistry - Adams and Raynor.
5. Handbook of Preparation Inorganic Chemistry. Vol. I and II -Brauer.
6. Manual in Dairy Chemistry - I.C.A.R. Sub-Committee on Dairy Education.
7. Chemical methods for environmental analysis - R. Ramesh and M.Anbu.

DSE- 3A & 3B: Practical –VI
Organic Chemistry Practical (2231618)

Total Credits: 4 Marks:100

Contact hrs: 48

Practical course objectives:

Learners should learn how to,

1. To develop skills required in chemistry such as the proper handling of apparatus and chemicals.
2. To make students capable of studying Chemistry in academic and Industrial courses and to expose the students to different processes used in Industries and their applications.
3. Separate the given binary Organic mixture and identify its components systemically.
4. Estimate amount of sugar present in sugar solution.
5. Estimate amount of nitro group present in m-nitro aniline solution.
6. Estimate sap value of oil.

Prepare the organic compound successfully by following given procedure.

I) Quantitative analysis:

Separation of binary mixture and identification of its components. (5g of mixture is to be given for separation.) At least 08 mixtures are to be separated.

Nature 1) Solid - Solid: 4 mixtures

2) Solid - Liquid: 2mixtures

3) Liquid - Liquid: 2mixtures

1) Solid - Solid Mixtures:

One mixture from each of the following types should be given:

i) Acid+Phenol ii) Acid +Base

iii) Acid+Neutral iv) Phenol +Base

v) Phenol+Neutral vi) Base +Neutral

2) Solid – Liquid Mixtures: One mixture of type Neutral + Neutral and One mixture of type Acid + Neutral should be given.

3) Liquid – Liquid Mixtures

One mixture of type Neutral + Neutral and One mixture of type Base + Neutral should be given.

Following compounds should be used for preparation of mixtures:

Acids: Benzoic acid, Phthalic acid, Salicylic acid, Cinnamic acid, Aspirin, Oxalic acid.

Phenols: α-naphthol, β-naphthol

Bases: o -nitroaniline, m-nitroaniline, p-nitroaniline, aniline.

Neutrals: Naphthalene, acetanilide, m-dinitrobenzene, chloroform, carbon tetrachloride, acetone, nitrobenzene, ethyl acetate, ethyl benzoate, urea and thiourea

II) Organic estimations: (Any three)

1) Estimation of sucrose

2) Estimation of nitro group

3) Saponification value of oil.

4) Estimation of formaldehyde from given formalin solution.

5) Estimation of acid and ester present in the given mixture of acid and ester.

6) Estimation of acid and amide from the mixture of acid and amide.

III) Organic Preparations: (any three)

N.B.: The preparation should be carried out on small scale. The starting compound should not be given more than 2 gm. Double burette method should be used for titration. Monitoring of the reaction and purification should be carried out by recrystallization and purity of the product in preparation should be checked by physical constant (M.P/B.P.) determination and thin layer Chromatography (TLC) with proper selection of the solvent system.

1) Preparation of m-nitroaniline from m-dinitrobenzene.

2) Preparation of aspirin from salicylic acid.

3) Preparation of benzene azo - β -naphthol.

4) Preparation of benzoic acid from cinnamic acid.

IV Preparation of Derivatives: (Any five)

N.B.: During practical course, name of the organic compound should not to be given.

1) Bromo derivative of aniline and cinnamic acid.
2) Nitro derivative of salicylic acid and nitrobenzene.
3) Benzoyl derivative of β-naphthol and aniline
4) Picrate derivative of anthracene and β-naphthol.
5) Oxalate and nitro derivatives of urea.
6) Anhydride derivative of phthalic acid.
7) Oxime derivatives of Ketones: Acetone and acetophenone.
8) Preparation of oxalic acid from cane sugar.
8) 2: 4 DNP of acetophenone.

Practical course outcomes:

Learners are able to,

1. Separate the given binary Organic mixture and identify its components systemically.
2. Estimate amount of sugar present in sugar solution.
3. Estimate amount of nitro group present in m-nitro aniline solution.
4. Estimate sap value of oil.
5. Prepare the organic compound successfully by following given procedure.

Reference Books:

1. Practical Organic Chemistry by A. I.Vogel.
2. Hand book of Organic qualitative analysis by H. T.Clarke.
3. A laboratory Hand Book of Organic qualitative analysis and separation by V. S. Kulkarni. Dastane Ramchandra & Co.
4. Practical Organic Chemistry by F.G.Mannand B.C.Saunders. Low-priced Text Book. ELBS.Longman.
5. Experiments in General Chemistryby C. N. R. Rao. Affiliated East-West Press Pvt. Ltd. Delhi.
6. Advanced Practical Organic Chemistry by N. K. Vishnoi. Vikas Publishing House Private Limited.
7. ComprehensivePracticalOrganicChemistryQualitativeAnalysisbyV.K.Ahluwalia, Sunita Dhingra. University Press.Distributor - Orient Longman Ltd.

8. Comprehensive Practical Organic Chemistry Preparation and Quantitative Analysis by V.K. Ahluwalia, Renu Agarwal. University Press.Distributor-Orient Longmann Ltd.
9. Practical Chemistry-Physical-Inorganic-Organic and Viva-voce by Balwant Rai Satija. Allied Publishers Private Limited.30
10. College Practical Chemistry by H. N. Patel, S. R. Jakali, H. P. Subhedar, Miss. S. P. Turakhia.Himalaya Publishing House,Mumbai.
11. College Practical Chemistry by Patel, Jakali, Mohandas, IsraneyTurakhia. Himalaya Publishing House,Mumbai.
12. Practice of thin layer chromatography by Joseph C. Touchstone, Murrell F. Dobbins. A Wiley - Interscience Publication John-Wiley & Sons.

DSE-4A & 4B: Practical VII

Analytical Chemistry Practical (2231619)

Total Credits: 4 Marks:100
Contact hrs: 48

Practical course objectives:

Learners should learn how to,

1. To develop skills required in chemistry such as the proper handling of apparatus and chemicals.
2. To make students capable of studying Chemistry in academic and Industrial courses and to expose the students to different processes used in Industries and their applications.
3. To acquire skill for handling instruments like potentiometer, P^H-meter, colorimeter, Refractometer etc.
4. To effectively understand the qualitative and quantitative analyses.

Q 1. Physical Chemistry: 30 M

a. Critical Solution Temperature: To determine the CST for phenol – water system.

b. To determine the percentage composition of unknown mixture by (i) graphical method and (ii) by composition law (Densities of pure liquids A & B be given) refractometrically.

c. To determine the molar refractivity of methyl acetate, ethyl acetate, n-hexane and carbon tetrachloride and calculate the refraction equivalents of C, H and Cl atoms refractometrically.

d. To verify Lambert - Beer's law using $CuSO_4$ solution colorimetrically.

e. To estimate Fe+++ ions by thiocynate method colorimetrically.

f. To estimate Fe+++ ions using salicylic acid by colorimetric titration colorimetrically.

g. To determine the dissociation constant of monobasic acid (Acetic acid) pH metrically.

h. To determine the dissociation constant of dibasic acid (Malonic acid) pH metrically

Q 2. Inorganic Chemistry: **30 M**

a) Determination of percentage of magnesium in the given sample of talcum powder by volumetric estimation.
b) Determination of amount of aluminium in the given solution of potash alum by volumetric estimation.
c) Determination of titrable acidity in the given sample of milk or lassi by volumetric estimation.
d) Determination of Chemical Oxygen Demand of the given sample of industrial effluent by dichromate method by volumetric estimation.
e) Determination of percentage purity of boric acid using supplied sodium hydroxide by volumetric estimation.
f) Determination of amount of sodium present in the given solution of common salt using cation exchange resin (By Acid Base titration).
g) Determination of amount of magnesium and zinc in the given solution containing (Mg^{++} and Zn^{++}) using anion exchange resin and standard solution of EDTA (By complexometric titration).

Q 3. Organic Chemistry: **30 M**

a. To estimate the amount of sucrose in given solution using Fehling's solution.

b. To estimate amount of nitro group from the solution of m-nitroaniline

c. To determine sap value of oil.

d. To estimate the amount of acid and amide present in the given mixture of acid and amide

e. To estimate the amount of acid and ester present in the given mixture of acid and ester

f. To estimate the amount of formaldehyde from given formalin solution

Course Outcomes:

1. Recall Lambert-Beer's law for CuSO4 solution by colorimetrically.
2. Determine critical solution temperature by phenol-water system.
3. Determine the nature of complex salts: Inner or Outer orbital complex
4. Calculate Oxidation State, Coordination number etc.
5. Determine the purity of commercial sample of milk/talcum powder / trioxalato aluminate (III), FAS, and Boric acid.
6. Estimate amount of sugar present in sugar solution.
7. Estimate amount of nitro group present in m-nitro aniline solution.

Dr. Mandle U.M.
Chairman

BOS in Chemistry

Academic Council 5(5.2)
15th June, 2022

CBCS BSc. PART III SEMESTER V

AECC- C

ENGLISH FOR COMMUNICATION-III (2231501)

SEE- 35 + CA- 15 = 50 marks

COURSE CREDITS 03L+01T=04 **COURSE CONTACT HOUR 60**

Course Objectives:

- To make the students comprehend English language in general
- To enhance the quest for knowledge and correct pronunciations
- To strengthen oral and written communication skills with grammar accuracy
- To galvanize soft skills

Course Outcomes:

By the end of the course the students will be able to:

- Use oral and written English effectively and fluently

- Demonstrate their knowledge of correct pronunciations
- Apply English language skills and grammar accuracy in clearing competitive examinations
- Apply their knowledge of Soft Skills to succeed in career as well as in practical life.

Module No and Title:
Module I: Prose

1. The Gift of the Magi: O' Henry
2. The Homecoming: Rabindranath Tagore
3. The California's Tale: Mark Twain

Module II: Poetry

1. The Solitary Reaper: William Wordsworth
2. The Queen's Rival: Sarojini Naidu
3. Oh! How I faint When I of You Do Write (Sonnet No 80) : William Shakespeare
4. The Road Not Taken: Robert Frost

Module. III: Pronunciation Skills

1) Basic Sounds in English
2) IPA Symbols
3) Phonetic Transcription
4) Stress and Intonation

Module. IV: Soft Skills

1. Types of 21st Century Skills
2. Learning Skills (4Cs)
3. Preparation for Employment

Reference Books:

BA/BSC Part III Compulsory English Literary Mindscapes-I PAH Solapur University, Solapur (With 20% new additions & changes)

CBCS BSc. PART III SEMESTER VI

AECC- D

ENGLISH FOR COMMUNICATION-IV (2231601)

SEE- 35 + CA- 15 = 50 marks

COURSE CREDITS 03L+01T=04 COURSE CONTACT HOUR 60

Course Objectives:

- To make the students comprehend English language in general
- To enhance the quest for knowledge and correct pronunciations
- To strengthen oral and written communication skills with grammar accuracy
- To galvanize soft skills

Course Outcomes:

By the end of the course the students will be able to:

- Use oral and written English effectively and fluently
- Demonstrate their knowledge of correct pronunciations
- Apply English language skills and grammar accuracy in clearing competitive examinations
- Apply their knowledge of Soft Skills to succeed in career as well as in practical life.

Module No and Title:

Module. I: Prose

1. Growing Up:	Joyce Cary
2. God See the Truth, but Waits:	Leo Tolstoy
3. On the Rule of The Road:	A. G. Gardiner

Module. II: Poetry

1. Sita:	Toru Dutt
2. My Last Duchess:	Robert Browning
3. Ode to Beauty:	John Keats
4. Song: Go and Catch a Falling Star:	John Donne

Module. III: Grammar

1. Simple and Multiple Sentences
2. Direct and Indirect Speech

Module. IV: Soft Skills

1. Literacy Skills
2. Life Skills
3. Employability Skills

Reference Books:

BA/BSC Part III Compulsory English Literary Mindscapes-I PAH Solapur University Solapur (With 20% new additions & changes)

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BOS in English