

A.G & S.G. SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE

Vuyyuru-521165

NAAC reaccredited at "A" level Autonomous -ISO 9001 – 2015 Certified



DEPARTMENT OF CHEMISTRY (U G)

B O S (2,4,6) Copy

Academic year 2023-2024

Date : 24-02-2024

A.G. & S.G. Siddhartha Degree College of Arts & Science, Autonomous, Vuyyuru .

Minutes of the Meeting of Board of Studies in Chemistry held at 11.00 A.M on 24-02-2024 in the Department of Chemistry.

Dr .G.Giriprasad

Presiding

Members Present:

- | | | |
|--------------------------------------|--------------------------|---|
| 1).....
(Dr.G.Giri Prasad) | Chairman | HOD, Dept. of Chemistry,
A.G. & S.G.S.Degree College,Vuyyuru. |
| 2).....
(Prof.D.Ramasekhar Reddy) | University Nominee | Assistant Professor,
Dept. of Chemistry,Krishna University, MTM. |
| 3).....
(Dr. S. Kalpana) | Academic Council Nominee | HOD, Dept. of Chemistry,
SDMS M College, Vijayawada. |
| 4).....
(Dr.. A. Indira) | Academic Council Nominee | Lecturer in Chemistry,
G.D.C, Dumpagadapa. |
| 5).....
(Dr. G Raja) | Industrialist | Manager, Q.A, Biophore india
Pharmaceuticals pvt ltd Hyd. |
| 6).....
(Smt. M. Sowjanya) | Student Nominee | Lecturer in Chemistry,
ANR College Gudivada. |
| 7).....
(Smt. M.V.Sanathi) | Member | Lecturer in Chemistry,
A.GS.G.S.Degree College,Vuyyuru |
| 8).....
(Sri. P.Suresh) | Member | Lecturer in Chemistry,
A.G. & S.G.S.Degree College,Vuyyuru. |
| 9).....
(Smt .M.Sanathi) | Member | Lecturer in Chemistry,
A.G.& S.G.S.Degree College,Vuyyuru. |
| 10).....
(Sri K.Ramesh) | Member | Rtd. Lecturer in Chemistry,
A.G.& S.G.S.Degree College,Vuyyuru. |
| 11).....
(Sri. J.Nageswara Rao) | Member | Rtd.Lecturer in Chemistry,
A.G.& S.G.S.Degree College,Vuyyuru. |

Agenda for B.O.S Meeting

1. To recommend the syllabus and model paper for II semester of I Degree B.Sc., Chemistry Major & Minor for the Academic year 2023-2024.
2. To recommend the syllabus and model papers for IV semester of II Degree B.Sc., Chemistry for the Academic year 2023-2024.
3. To recommend the syllabus and model papers for V/VI semester of III Degree B.Sc. Chemistry for the Academic year 2023-2024.
4. To recommend the Guidelines to be followed by the question paper setters in Chemistry for II, IV,V/VI Semester – end exams.
5. To recommend the teaching and evaluation methods to be followed under Autonomous status.
6. Any suggestions regarding certificate course, seminars, workshops, Guest lecture to be organized.
7. Recommend the panel of paper setters and Examiners to the controller of Examinations of
8. Any other matter.

Chairman

RESOLUTIONS

1. It is resolved to follow the **syllabus of APSCHE (theory and practical) for II semesters of I B.Sc.** Chemistry Major & Minor for the Academic year 2023--2024.

Major Chemistry Title :1. GENERAL AND INORGANIC CHEMISTRY

Practical Paper : Qualitative inorganic analysis (Minimum of Six simple salts should be analysed)

Major Chemistry Title :2. INORGANIC CHEMISTRY- I

Practical Paper : Preparation of Inorganic compounds:

Minor Chemistry Title : GENERAL AND INORGANIC CHEMISTRY

Practical Paper : Qualitative inorganic analysis (Minimum of Six simple salts should be analysed)

Two papers (Practical&Theory)Should be Allotted for Chemistry Major Students

One paper (Practical&Theory)Should be Allotted for Chemistry Minor Students

2. It is resolved to follow the **syllabus of APSCHE (theory and practical) for IV semesters of II B.Sc** for the Academic year 2023--2024.
3. It is resolved to follow the **syllabus of APSCHE (theory and practical) for VI semesters of III B.Sc.** for the Academic year 2023--2024.

- It is resolved to introduce Spectrophotometry instead of water analysis. Unit-5 of Analytical methods in chemistry-1 of 2022-2023 for 2023-2024.

- It resolved to follow the same syllabus of second paper (Analytical methods in chemistry-2) of APSCHE (theory and practical)

4. It is resolved to follow the **guidelines** to be followed by the question paper setters of Chemistry for II,IV & V/VI semesters of Degree B.Sc. for the Academic Year 2023-2024.
5. It is resolved to continue the following teaching and evaluation methods for Academic year 2023-24.

Teaching Methods:

- Besides the conventional methods of teaching, we use modern technology i.e. using of LCD projector to display on U boards etc, for better understanding of concepts.
- **Evaluation of a student is done by the following procedure:**
- **Internal Assessment Examinations:**
- Out of maximum 100 marks in each paper for I B.Sc, 30 marks shall be allocated for internal assessment. Out of these 30 marks, 20 marks are allocated for announced tests (i.e. IA-1 & IA-2).
- Out of maximum 100 marks in each paper for II B.Sc, 30 marks shall be allocated for internal assessment. Out of these 30 marks 20 marks are allocated for announced tests (i.e. IA-1 & IA-2).
- Out of maximum 100 marks in each paper for III B.Sc 25 marks shall be allocated for internal assessment. Out of these 25 marks, 15 marks are allocated for announced tests (i.e. IA-1 & IA-2).
- Two announced tests will be conducted and average of these two tests shall be deemed as the marks obtained by the student, 5 marks are allocated on the basis of candidate's percentage of attendance and remaining 5 marks are allocated for the innovative component like assignment/quiz/seminars for I,II, B.Sc.
- Two announced tests will be conducted and average of these two tests shall be deemed as the marks obtained by the student. 5 marks are allocated for the innovative component like assignment/quiz/seminars for III B.Sc. & 5 marks are allocated for the Activity.
- There is no pass minimum for internal assessment for I, II, III B.Sc.

Semester – End Examination:

- The maximum marks for II, IV,V B.Sc Semester – End examination shall be 70/70/75marks duration of the examination shall be 3 hours. Even though the candidate is absent for two IA exams /obtain Zero marks the external marks are considered (if the candidate gets 40/70/75) and the result shall be declared as “PASS”.
 - Semester – End examinations shall be conducted in theory papers at the end of every semester, while in practical papers, these examinations are conducted at the end of II,IV&V/VI semesters for I, II & III B.Sc for 50 marks.
6. Discussed and recommended for organizing certificate course, seminars, Guest lecturers,workshops to upgrade the knowledge of students, for the approval of the academic council.
 7. Discussed and empowered the Head of the department of Chemistry to suggest the panel of paper setters and examiners to the controller of examinations
 8. NIL.

Chairman



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Title of the Paper: GENERAL AND INORGANIC CHEMISTRY

Semester: II

Course Code	23CHMAL121	Course Delivery Method	Class Room / Blended Mode
Credits	3	CIA Marks	30
No. of Lecture Hours / Week	4	Semester End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction : 2023-24	Year of Offering: 2023-24	Year of Revision: 2023-24	Percentage of Revision: 100

Course Outcomes:

At the end of the course the student will be able to-

1. Understand the structure of atom and the arrangement of elements in the periodic table.
2. Understand the nature and properties of ionic compounds.
3. Identify the structure of a given inorganic compound.
4. Explain the existence of special types of compounds through weak chemical forces.
5. Define acids and bases and predict the nature of salts.

Syllabus

Course Details

Unit	Learning Units	Lecture Hours
GENERAL AND INORGANIC CHEMISTRY		
I	<p>Atomic Structure and Periodic table: Electronic configuration: Bohr theory, dual nature of electrons, Heisenberg uncertainty principle, the Schrodinger equation, significance of wave functions, normalization of wave function, radial and angular wave functions, Pauli's exclusion principle, Hund's rule, sequence of energy levels (Aufbau principle).</p> <p>Periodicity: periodic law and arrangement of elements in the periodic table, IUPAC nomenclature and group number, horizontal, vertical, and diagonal relationships in the periodic table. 1.3 General properties of atoms: size of atoms and ions-atomic radii, ionic radii, covalent radii; trend in ionic radii, ionization potential, electron affinity; electronegativity - Pauling, Mulliken-Jaffe, Allred-Rochow definitions; oxidation states and variable valency; isoelectronic relationship; inert-pair effect.</p>	9h
II	<p>Ionic bond : Properties of ionic compounds, factors favouring the formation of ionic compounds- ionization potential, electron affinity, and electronegativity. Lattice energy: definition, factors affecting lattice energy, Born-Haber cycle-enthalpy of formation of ionic compound and stability. Stability of ionic compounds in terms of ΔH_f and U_o. Solubility and thermal stability of ionic compounds. Covalent character in ionic compounds-polarization and Fajan's rules; effects of polarization-solubility, melting points, and thermal stability of typical ionic compounds.</p>	9h
III	<p>The Covalent Bond: Valence Bond theory-arrangement of electrons in molecules, hybridization of atomic orbitals and geometry of molecules- $BeCl_2$, BF_3, CH_4, PCl_5, SF_6 – VSEPR model- effect of bonding and nonbonding electrons on the structure of molecules, effect of electronegativity, isoelectronic principle, illustration of structures by VESPR model- NH_3, H_2O, SF_4, ICl^{-4}, ICl^{-2}, XeF_4, XeF_6.</p> <p>Molecular orbital theory -LCAO method, construction of M.O. diagrams for homo- nuclear and hetero-nuclear diatomic molecules (N_2, O_2, CO and NO).</p>	9h
IV	<p>Metallic and Weak Bonds: The Metallic bond: metallic properties, free electron theory, Valence Bond Theory, band theory of metals. Explanation of conductors, semiconductors and insulators. Weak bonds: hydrogen bonding-intra- and intermolecular hydrogen bonding, influence on the physical properties of molecules, comparison of hydrogen bond strength and properties of hydrogen bonded N, O and F compounds; associated molecules-ethanol and acetic acid; Vanderwaals forces, ion dipole-dipole interactions.</p>	9h
V	<p>Acids and Bases:</p> <p>Theories of acids and bases: Arrhenius theory, Bronsted-Lowry theory, Lewis theory, the solvent system, Nonaqueous solvents: classification-protonic and aprotic solvents, liquid ammonia as solvent-solutions of alkali and alkaline earth metals in ammonia.</p> <p>Types of chemical reactions: acid-base, oxidation-reduction, calculation of oxidation number. Definition of pH, pKa, pKb. Types of salts, Salt hydrolysis. Pearson's concept, HSAB principle & its importance, bonding in Hard-Hard and Soft-Soft combinations.</p>	9h

List of Reference Books:

1. J. D. Lee, Concise Inorganic Chemistry, 5th ed., Blackwell Science, London, 1996.
2. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, Shoban Lal Nagin Chand and Co., 1996.
3. D. F. Shriver and P. W. Atkins, Inorganic Chemistry, 3rd ed., W. H. Freeman and Co, London

**A.G. & S.G.SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE (AUTONOMOUS),
VUYYURU.**

SEMESTER – II PAPER-II	PAPER CODE : 23CHMAL121 ACADEMIC YEAR-2023-24
GENERAL AND INORGANIC CHEMISTRY	

Time: 3 hours

Maximum Marks: 70

PART- A

Answer the following questions. Each carries FOUR marks

5 X 4 = 20 M

1. a) Describe Pauli's exclusion principle. **L1-CO1**

Or

b) Discuss inert-pair effect. **L1-CO1**

2. a) Tell factors favouring the formation of ionic compounds. **L1-CO2**

Or

b) Describe Fajan's rules. **L1-CO2**

3. a) Explain about Valence Bond theory. **L2-CO3**

Or

b) Summarize Hybridization and structure of BF_3 , CH_4 by using VBT. **L2-CO3**

4. a) Interpret free electron theory. **L2-CO4**

Or

b) State ion dipole-dipole interactions. **L2-CO4**

5. a) Explain Bronsted-Lowry theory and Lewis theory of acid and base. **L2-CO5**

Or

b) Define pH , pK_a , pK_b with an example each. **L2-CO5**

PART- B

Answer ALL the questions. Each carries TEN marks

5 X 10 = 50 M

6 (a). Explain Bohr theory and dual nature of electrons. **L2-CO1**

Or

(b). Explain ionic radii, covalent radii, ionization potential, electron affinity; electro negativity. **L2-CO1**

7 (a). Describe Born-Haber cycle. **L1-CO2**

Or

(b). Define Lattice energy. Various factors affecting lattice energy. **L1-CO2**

8.(a). Explain VSEPR theory? Write vesper model structures of NH_3 , XeF_4 , XeF_6 **L1-CO3**

Or

(b). Construct the M.O. diagrams for N_2 and CO . **L1-CO3**

9.(a). Explain band theory of metals. **L2-CO4**

Or

(b). Explain hydrogen bonding-intra- and intermolecular hydrogen bonding. **L2-CO4**

10.(a). Define Nonaqueous solvents and write the classification of Nonaqueous solvents. **L2-CO5**

Or

(b). Discuss Pearson's concept and explain HSAB principle & its importance. **L2-CO5**

**A.G.&S.G.SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE (AUTONOMOUS),
VUYYURU.**

(Accredited at "A" Grade by NAAC, Bangalore)

PRACTICAL SYLLABUS

GENERAL AND INORGANIC CHEMISTRY	PAPER CODE : 23CHMAP121 ACADEMIC YEAR-2023-24
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30 hrs (2h/w)

Credits-2

Practical- I

Qualitative Analysis of SIMPLE SALT

Qualitative inorganic analysis (Minimum of Six simple salts should be analysed) **50 M**

Course outcomes:

At the end of the course, the student will be able to;

1. Understand the basic concepts of qualitative analysis of inorganic simple salt.
2. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
3. Apply the concepts of common ion effect, solubility product and concepts related to qualitative analysis

Syllabus

Analysis of SIMPLE SALT 50 M

Analysis of simple salt containing ONE anion and ONE cation from the following: Anions: Carbonate, Sulphate, Chloride, Bromide, Acetate, Nitrate, Borate, Phosphate.

Cations: Lead, Copper, Iron, Aluminium, Zinc, Nickel, Manganese, Calcium, Strontium, Barium, Magnesium and Ammonium.

Co-curricular activities and Assessment Methods

1. Continuous Evaluation: Monitoring the progress of student's learning.
2. Class Tests, Work sheets and Quizzes
3. Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality
4. SEMESTER-End Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the SEMESTER.

Reference books:

1. Vogel's Qualitative Inorganic Analysis, Seventh edition, Pearson

SCHEME OF VALUATION

1. INTERNAL MARKS- Record-10M
2. EXTERNAL MARKS-40
3. Analysis of Simple salt -30M
4. Viva questions = 10 M

TOTAL = 50 M



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Title of the Paper: INORGANIC CHEMISTRY- I

Semester: II

Course Code	23CHMAL122	Course Delivery Method	Class Room / Blended Mode
Credits	3	CIA Marks	30
No. of Lecture Hours / Week	4	Semester End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction : 2023-24	Year of Offering: 2023-24	Year of Revision: 2023-24	Percentage of Revision: 100

Course Outcomes:

At the end of the course the student will be able to-

1. Understand the basic concepts of p-block elements.
2. Explain the concepts of d-block elements
3. Distinguish lanthanides and actinides.
4. Describe the importance of radioactivity.

Syllabus

Course Details

Unit	Learning Units	Lecture Hours
INORGANIC CHEMISTRY-I		
I	<p>Chemistry of p-block elements</p> <p>Group13:Preparation & structure of Diborane, Borazine and (BN)_x</p> <p>Group14:Preparation, classification and uses of silicones and Silanes.</p> <p>Group 15:Preparation & structure of Phosphonitrilic Chloride P₃N₃Cl₆.</p>	9h
II	<p>Chemistry of p-block elements – II:</p> <p>Group 16: Classification of Oxides, structures of oxides and Oxoacids of Sulphur</p> <p>Group 17: Preparation and Structures of Interhalogen compounds. Pseudohalogens,</p>	9h
III	<p>Chemistry of d-block elements:</p> <p>Characteristics of d-block elements with special reference to electronic configuration, variable valence, colour, magnetic properties, catalytic properties and ability to form complexes. Stability of various oxidation states of 3d series-Latimer diagrams.</p>	9h
IV	<p>Chemistry of f-block elements:</p> <p>Chemistry of lanthanides - electronic configuration, oxidation states, lanthanide contraction, consequences of lanthanide contraction, colour, magnetic properties. Separation of lathanides by ion exchange method.</p> <p>Chemistry of actinides - electronic configuration, oxidation states, actinide contraction, comparison of lanthanides and actinides.</p>	9h
V	<p>Radioactivity</p> <p>Definition, Isotopes, n/p ratio, binding energy, types of radioactivity, Soddy-Fajan's displacement law, Law of Radioactivity, Radioactive decay series, Nuclear Reactions-fission and fusion, Applications of radioactivity.</p>	9h

List of Reference Books:

1. Basic Inorganic Chemistry by Cotton and Wilkinson
2. Advance Inorganic chemistry vol-I by Satya Prakash
3. Inorganic chemistry by Puri and Sharma
4. Concise Inorganic Chemistry by J D Lee
5. Nuclear Chemistry by Maheshwar Sharon

**A.G. & S.G.SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE
(AUTONOMOUS), VUYYURU.**

SEMESTER – II PAPER-II

PAPER CODE : 23CHMAL122
ACADEMIC YEAR-2023-24

INORGANIC CHEMISTRY-I

Time: 3 hours

Maximum Marks: 70

PART- A

Answer the following questions. Each carries FOUR marks

5 X 4 = 20 M

1. a) Describe Preparation & structure of Borazine. **L1-CO1**

Or

b) Discuss Preparation & structure of Phosphonitrilic Chloride. **L1-CO1**

2. a) Tell structures of oxides and Oxo acids of Sulphur. **L1-CO2**

Or

b) Describe Pseudo halogens. **L1-CO2**

3. a) Explain electronic configuration of d-block elements. **L2-CO3**

Or

b) Explain ability to form complexes of d-block elements. **L2-CO3**

4. a) compare lanthanides and actinides – **L2-CO4**

Or

b) State electronic configuration of lanthanides. **L2-CO4**

5. a) Define Isotopes and n/p ratio. – **L2-CO5**

Or

b) Define Nuclear Reactions-fission and fusion. **L2-CO5**

PART- B

Answer ALL the questions. Each carries TEN marks

5 X 10 = 50 M

6 (a). Explain Preparation & structure of Diborane. **L2-CO1**

(or)

(b). Explain Preparation, classification and uses of silicones and Silanes. **L2-CO1**

7 (a). Discuss Classification of Oxides with an examples. **L1-CO2**

(or)

(b). Describe Preparation and Structures of Interhalogen compounds. **L1-CO2**

8.(a). Explain variable valence, magnetic properties and catalytic properties of d-block elements. **L1-CO3**

(or)

(b). Explain colour and Stability of various oxidation states of 3d series. **L1-CO3**

9.(a). Explain lanthanide contraction and what are the consequences of lanthanide contraction. **L2-CO4**

(or)

(b). Explain Separation of lanthanides by ion exchange method. **L2-CO4**

10.(a). Discuss types of radioactivity and Soddy-Fajan's displacement law. **L2-CO5**

(or)

(b). Discuss Radioactive decay series and Applications of radioactivity. **L2-CO5**

**A.G.&S.G.SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE (AUTONOMOUS),
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PRACTICAL SYLLABUS**

INORGANIC CHEMISTRY-I

**PAPER CODE : 23CHMAP122
ACADEMIC YEAR-2023-24**

30 hrs (2h/w)

Credits-2

Course outcomes:

At the end of the course, the student will be able to:

1. CO1. Remember the basic concepts of inorganic preparations. PO6
2. CO2. Understand use of glassware, equipment and chemicals and follow experimental procedures in the laboratory. PO6
3. CO3. Apply the properties of various elements for the preparation of inorganic compounds. PO7

Syllabus:

Preparation of Inorganic compounds:

1. Crystallization of compounds and determination of melting point.
2. Preparation of Cuprous chloride.
3. Preparation of Potash Alum.
4. Preparation of Chrome Alum.
5. Preparation of Ferrous oxalate
6. Preparation of Ferrous ammonium sulphate.

Co-curricular activities and Assessment Methods:

- Continuous Evaluation: Monitoring the progress of student's learning
- Class Tests, Worksheets and Quizzes
- Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality
- SEMESTER -End Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the SEMESTER.

Reference books:

1. Vogel's Quantitative Inorganic Analysis, Seventh edition, Pearson.



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Title of the Paper: GENERAL AND INORGANIC CHEMISTRY

Semester: II (Minor Students)

Course Code	23CHMIL121	Course Delivery Method	Class Room / Blended Mode
Credits	3	CIA Marks	30
No. of Lecture Hours / Week	4	Semester End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction : 2023-24	Year of Offering: 2023-24	Year of Revision: 2023-24	Percentage of Revision: 100

Course Outcomes:

At the end of the course the student will be able to-

6. Understand the structure of atom and the arrangement of elements in the periodic table.
7. Understand the nature and properties of ionic compounds.
8. Identify the structure of a given inorganic compound.
9. Explain the existence of special types of compounds through weak chemical forces.
10. Define acids and bases and predict the nature of salts.

Syllabus

Course Details

Unit	Learning Units	Lecture Hours
GENERAL AND INORGANIC CHEMISTRY		
I	<p>Atomic Structure and Periodic table: Electronic configuration: Bohr theory, dual nature of electrons, Heisenberg uncertainty principle, the Schrodinger equation, significance of wave functions, normalization of wave function, radial and angular wave functions, Pauli's exclusion principle, Hund's rule, sequence of energy levels (Aufbau principle).</p> <p>Periodicity: periodic law and arrangement of elements in the periodic table, IUPAC nomenclature and group number, horizontal, vertical, and diagonal relationships in the periodic table. 1.3 General properties of atoms: size of atoms and ions-atomic radii, ionic radii, covalent radii; trend in ionic radii, ionization potential, electron affinity; electronegativity - Pauling, Mulliken-Jaffe, Allred-Rochow definitions; oxidation states and variable valency; isoelectronic relationship; inert-pair effect.</p>	9h
II	<p>Ionic bond : Properties of ionic compounds, factors favouring the formation of ionic compounds- ionization potential, electron affinity, and electronegativity. Lattice energy: definition, factors affecting lattice energy, Born-Haber cycle-enthalpy of formation of ionic compound and stability. Stability of ionic compounds in terms of ΔH_f and U_0. Solubility and thermal stability of ionic compounds. Covalent character in ionic compounds-polarization and Fajan's rules; effects of polarization-solubility, melting points, and thermal stability of typical ionic compounds.</p>	9h
III	<p>The Covalent Bond: Valence Bond theory-arrangement of electrons in molecules, hybridization of atomic orbitals and geometry of molecules- BeCl_2, BF_3, CH_4, PCl_5, SF_6 – VSEPR model- effect of bonding and nonbonding electrons on the structure of molecules, effect of electronegativity, isoelectronic principle, illustration of structures by VESPR model- NH_3, H_2O, SF_4, ICl^{-4}, ICl^{-2}, XeF_4, XeF_6.</p> <p>Molecular orbital theory -LCAO method, construction of M.O. diagrams for homo- nuclear and hetero-nuclear diatomic molecules (N_2, O_2, CO and NO).</p>	9h
IV	<p>Metallic and Weak Bonds: The Metallic bond: metallic properties, free electron theory, Valence Bond Theory, band theory of metals. Explanation of conductors, semiconductors and insulators. Weak bonds: hydrogen bonding-intra- and intermolecular hydrogen bonding, influence on the physical properties of molecules, comparison of hydrogen bond strength and properties of hydrogen bonded N, O and F compounds; associated molecules-ethanol and acetic acid; Vanderwaals forces, ion dipole-dipole interactions.</p>	9h
V	<p>Acids and Bases:</p> <p>Theories of acids and bases: Arrhenius theory, Bronsted-Lowry theory, Lewis theory, the solvent system, Nonaqueous solvents: classification- protonic and aprotic solvents, liquid ammonia as solvent-solutions of alkali</p>	9h

	and alkaline earth metals in ammonia. Types of chemical reactions: acid-base, oxidation-reduction, calculation of oxidation number. Definition of pH, pK _a , pK _b . Types of salts, Salt hydrolysis. Pearson's concept, HSAB principle & its importance, bonding in Hard-Hard and Soft-Soft combinations.	
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List of Reference Books:

4. J. D. Lee, Concise Inorganic Chemistry, 5th ed., Blackwell Science, London, 1996.
5. B. R. Puri, L. R. Sharma, K. C. Kalia, Principles of Inorganic Chemistry, Shoban Lal Nagin Chand and Co., 1996.
6. D. F. Shriver and P. W. Atkins, Inorganic Chemistry, 3rd ed., W. H. Freeman and Co, London

**A.G. & S.G.SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE (AUTONOMOUS),
VUYYURU.**

SEMESTER – II PAPER-II	PAPER CODE : 23CHMIL121 ACADEMIC YEAR-2023-24
GENERAL AND INORGANIC CHEMISTRY	

Time: 3 hours

Maximum Marks: 70

PART- A

Answer the following questions. Each carries FOUR marks

5 X 4 = 20 M

1. a) Describe Pauli's exclusion principle. **L1-CO1**

Or

b) Discuss inert-pair effect. **L1-CO1**

2. a) Tell factors favouring the formation of ionic compounds. **L1-CO2**

Or

b) Describe Fajan's rules. **L1-CO2**

3. a) Explain about Valence Bond theory. **L2-CO3**

Or

b) Summarize Hybridization and structure of BF_3 , CH_4 by using VBT. **L2-CO3**

4. a) Interpret free electron theory. **L2-CO4**

Or

b) State ion dipole-dipole interactions. **L2-CO4**

5. a) Explain Bronsted-Lowry theory and Lewis theory of acid and base. **L2-CO5**

Or

b) Define pH , pK_a , pK_b with an example each. **L2-CO5**

PART- B

Answer ALL the questions. Each carries TEN marks

5 X 10 = 50 M

6 (a). Explain Bohr theory and dual nature of electrons. **L2-CO1**

Or

(b). Explain ionic radii, covalent radii, ionization potential, electron affinity; electro negativity. **L2-CO1**

7 (a). Describe Born-Haber cycle. **L1-CO2**

Or

(b). Define Lattice energy. Various factors affecting lattice energy. **L1-CO2**

8.(a). Explain VSEPR theory? Write VSEPR model structures of NH_3 , XeF_4 , XeF_6 **L1-CO3**

Or

(b). Construct the M.O. diagrams for N_2 and CO . **L1-CO3**

9.(a). Explain band theory of metals. **L2-CO4**

Or

(b). Explain hydrogen bonding-intra- and intermolecular hydrogen bonding. **L2-CO4**

10.(a). Define Nonaqueous solvents and write the classification of Nonaqueous solvents. **L2-CO5**

Or

(b). Discuss Pearson's concept and explain HSAB principle & its importance. **L2-CO5**

**A.G.&S.G.SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE (AUTONOMOUS),
VUYYURU.
(Accredited at "A" Grade by NAAC, Bangalore)
PRACTICAL SYLLABUS**

**GENERAL AND INORGANIC
CHEMISTRY**

**PAPER CODE : 23CHMIP121
ACADEMIC YEAR-2023-24**

30 hrs (2h/w)

Credits-2

Practical- I

Qualitative Analysis of SIMPLE SALT

Qualitative inorganic analysis (Minimum of Six simple salts should be analysed) **50 M**

Course outcomes:

At the end of the course, the student will be able to;

4. Understand the basic concepts of qualitative analysis of inorganic simple salt.
5. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
6. Apply the concepts of common ion effect, solubility product and concepts related to qualitative analysis

Syllabus

Analysis of SIMPLE SALT

50 M

Analysis of simple salt containing ONE anion and ONE cation from the following: Anions:
Carbonate, Sulphate, Chloride, Bromide, Acetate, Nitrate, Borate, Phosphate.
Cations: Lead, Copper, Iron, Aluminium, Zinc, Nickel, Manganese, Calcium, Strontium, Barium,
Magnesium and Ammonium.

Co-curricular activities and Assessment Methods

5. Continuous Evaluation: Monitoring the progress of student's learning.
6. Class Tests, Work sheets and Quizzes
7. Presentations, Projects and Assignments and Group Discussions: Enhances critical thinking skills and personality
8. SEMESTER-End Examination: critical indicator of student's learning and teaching methods adopted by teachers throughout the SEMESTER.

Reference books:

1. Vogel's Qualitative Inorganic Analysis, Seventh edition, Pearson

SCHEME OF VALUATION

5. INTERNAL MARKS- Record-10M
6. EXTERNAL MARKS-40
7. Analysis of Simple salt -30M
8. Viva questions = 10 M

TOTAL = 50 M



A.G & S.G. SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE
Vuyyuru-521165

NAAC reaccredited at "A" level

Autonomous -ISO 9001 – 2015 Certified

Title of the Paper: INORGANIC, ORGANIC AND PHYSICAL CHEMISTRY

Semester: IV

Course Code	23CHET01	Course Delivery Method	Class Room / Blended Mode
Credits	3	CIA Marks	30
No. of Lecture Hours / Week	4	Semester End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction : 2021-22	Year of Offering: 2022-23	Year of Revision: 2022-23	Percentage of Revision: 0

Course Outcomes:

At the end of the course, the student will be able to:

1. To learn about the laws of absorption of light energy by molecules and the subsequent photochemical reactions.
2. To understand the concept of quantum efficiency and mechanisms of photochemical reactions

Syllabus

Course Details

Unit	Learning Units	Lecture Hours
INORGANIC CHEMISTRY		
I	<p>Organometallic Compounds: Definition and classification of organometallic Compounds on the basis of bond type, Concept of hapticity of organic ligands. Metal carbonyls: 18electronrule, electron count of mononuclear, poly nuclear and substituted metal carbonyls of 3d series. General methods of preparation of mono and binuclear carbonyls of 3d series. P-acceptor behaviour of carbon monoxide. Synergic effects (VB approach) - (MO diagram of CO can be referred to for synergic effect to IR frequencies).</p>	8h
ORGANIC CHEMISTRY		
II	<p>Carbohydrates: Occurrence, classification and their biological importance, Monosaccharides: Constitution and absolute configuration of glucose and fructose, epimers and anomers, mutarotation, determination of ring size of glucose and fructose, Haworth projections and conformational structures; Interconversions of aldoses and ketoses; Killiani-Fischer synthesis and Ruff degradation; Disaccharides– Elementary treatment of maltose, lactose and sucrose. Polysaccharides–Elementary treatment of starch.</p>	8h
III	<p>1. Amino acids and proteins: Introduction: Definition of Amino acids, classification of Amino acids into alpha, beta, and gamma amino acids. Natural and essential amino acids - definition and examples, classification of alpha amino acids into acidic, basic and neutral amino acids with examples. Methods of synthesis: General methods of synthesis of alpha amino acids (specific examples - Glycine, Alanine, valine and leucine) by following methods: a) from halogenated carboxylic acid b) Gabriel Phthalimide synthesis c) strecker's synthesis.</p> <p>Physical properties: Zwitter ion structure - salt like character - solubility, melting points, amphoteric character, definition of isoelectric point.</p> <p>Chemical properties: General reactions due to amino and carboxyl groups - lactams from gamma and delta amino acids by heating- peptide bond (amide linkage). Structure and nomenclature of peptides and proteins.</p> <p>2. Heterocyclic Compounds: Introduction and definition: Simple five membered ring compounds with one hetero atom Ex. Furan. Thiophene and pyrrole - Aromatic character – Preparation from 1, 4, -dicarbonyl compounds, Paul-Knorr synthesis. Properties: Acidic character of pyrrole - electrophilic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation under mild conditions - Diels Alder reaction in furan. Pyridine – Structure - Basicity - Aromaticity- Comparison with pyrrole- one method of preparation and properties - Reactivity towards Nucleophilic substitution reaction.</p>	6h
IV	<p>Nitrogen Containing Functional Groups:Preparation, properties and important reactions of nitro compounds, amines and diazonium salts.</p> <p>1.Nitrohydrocarbons: Nomenclature and classification-nitro hydrocarbons, structure -Tautomerism of nitroalkanes leading to aci and keto form, Preparation</p>	7h

	<p>of Nitroalkanes, reactivity -halogenation, reaction with HONO (Nitrous acid),Nef reaction and Mannich reaction leading to Micheal addition and reduction.</p> <p>2.Amines: Introduction, classification, chirality in amines (pyramidal inversion), importance and general methods of preparation.</p> <p>Properties : Physical properties, Basicity of amines: Effect of substituent, solvent and steric effects. Distinction between Primary,Secondary and tertiary amines using Hinsberg's method and nitrous acid.</p> <p>Discussion of the following reactions with emphasis on the mechanistic pathway: Gabriel Phthalimide synthesis, Hoffmann-Bromamide reaction, Carbylamine reaction, Mannich reaction, Hoffmann's exhaustive methylation, Hofmann-elimination reaction and Cope-elimination.</p> <p>Diazonium Salts: Preparation and Synthetic applications of diazonium salts including preparation of arenes, haloarenes, phenols, cyano and nitro compounds. Coupling reactions of diazonium salts (preparation of azo dyes).</p>	<p>3h</p> <p>11h</p>
V	<p>1.Photochemistry:Difference between thermal and photochemical processes, Laws of photochemistry- Grothus- Draper's law and Stark-Einstein's law of photochemical equivalence, Quantum yield- Photochemical reaction mechanism- hydrogen- chlorine and hydrogen- bromine reaction. Qualitative description of fluorescence, phosphorescence, Jablonski diagram, Photosensitized reactions- energy transfer processes (simple example).</p> <p>2.Thermodynamics:The first law of thermodynamics-statement, definition of internal energy and enthalpy, Heat capacities and their relationship, Joule-Thomson effect- coefficient, Calculation of work for the expansion of perfect gas under isothermal and adiabatic conditions for reversible processes, State function. Temperature dependence of enthalpy of formation- Kirchoff's equation, Second law of thermodynamics Different Statements of the law, Carnot cycle and its efficiency, Carnot theorem, Concept of entropy, entropy as a state function, entropy changes in reversible and irreversible processes. Entropy changes in spontaneous and equilibrium processes. Third law of thermodynamics, Nernst heat theorem, Spontaneous and non- spontaneous processes, Helmholtz and Gibbs energies-Criteria for spontaneity.</p>	<p>5h</p> <p>12h</p>

List of Reference Books

1. Concise coordination chemistry by Gopalan and Ramalingam
2. Coordination Chemistry by Basalo and Johnson
3. Organic Chemistry by G.Mareloudan, Purdue Univ
4. Text book of physical chemistry by S Glasstone
5. Concise Inorganic Chemistry by J.D.Lee
6. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan
7. A Text Book of Organic Chemistry by Bahl and Arunbahl
8. A Text Book of Organic chemistry by I L Finar Vol II
9. A Text Book of Organic chemistry by I L Finar Vol III
10. Advanced physical chemistry by Gurudeep Raj

**A.G. & S.G.SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE (AUTONOMOUS),
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SEMESTER – IV PAPER-IV	PAPER CODE : 23CHET01
PAPER TITLE: INORGANIC, ORGANIC & PHYSICAL CHEMISTRY	ACADEMIC YEAR-2023-24

Time: 3 hours

Maximum Marks: 70

PART- A

Answer any FIVE of the following questions. Each carries FOUR marks 5 X 4 = 20 M

1. a) Describe the 18 electron rule of mono nuclear and polynuclear metal carbonyls with suitable examples. **L1-CO1**

OR

b) Discuss concept of hapticity of organic ligands **L1-CO1**

2. a) Tell epimers and anomers. Give examples. **LI –CO2**

OR

b) Discuss Inter conversions of aldoses and ketoses. . **LI –CO2**

3. a) Discuss about iso electric point and zwitter ion. **L1-CO3**

OR

b) Summarize the Paul-Knorr synthesis of five membered heterocyclic compounds. **L1-CO3**

4. a) Interpret Tautomerism shown by nitro alkanes –**L2-CO4**

OR

b) Describe the basic nature of amines. -**L1-CO4**

5. a) Compare the differences between thermal and photochemical reactions. –**L2-CO5**

OR

b) Infer heat capacities and derive $C_p - C_v = R$ -**L2-CO5**

PART- B

Answer ALL the questions. Each carries TEN marks

5 X 10 = 50M

6. (a). Comment on organo metallic compounds? Discuss their Classification on the basis of type of bonds with examples. **L2-CO1**

OR

(b). Interpret the general methods of preparations of mono & bi-nuclear

carbonyls of 3d series. **L2-CO1**

7.(a). Describe the constitution, configuration and ring size of glucose. Draw the Haworth and Conformational structure of glucose. **L1-CO2**

OR

(b). (i) Explain Ruff's degradation. **L1-CO2**

(ii) Explain Kiliani- Fischer synthesis.

8. (a). Explain amino acids? Write any three general methods of preparation of amino acids. **L1-CO3**

OR

(b). Describe the aromatic character of Furan, Thiophene and Pyrrole. **L1-CO3**

9. (a). Interpret the mechanism for the following. **L2-CO4**

(i) Nef reaction (ii) Mannich reaction

OR

(b). (i) Summarize Hinsberg separation of amines. **L2-CO4**

(ii) Discuss any three synthetic applications of diazonium salts.

10. (a). Comment on quantum yield? Explain the photochemical combination of Hydrogen-Chlorine and Hydrogen - Bromine. **L2-CO5**

OR

(b). Comment on entropy. Describe entropy changes in the reversible and irreversible process.

L2-CO5

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PRACTICAL SYLLABUS**

**Practical Paper – IV
Organic Qualitative analysis**

**PAPER CODE : 23CHEP01
ACADEMIC YEAR-2023-24**

30 hrs (2h/w)

Credits-2

Course outcomes:

At the end of the course, the student will be able to;

1. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
2. Determine melting and boiling points of organic compounds.
3. Understand the application of concepts of different organic reactions studied in theory part of organic chemistry.

Organic Qualitative analysis

50 M

Analysis of an organic compound through systematic qualitative procedure for functional group identification including the determination of melting point and boiling point with suitable derivatives.

- Alcohols,
- Phenols,
- Aldehydes and Ketones,
- Carboxylic acids,
- Aromatic primary amines,
- amides and
- simple sugars.

SCHEME OF VALUATION

1. INTERNAL MARKS- Record-10M
2. EXTERNAL MARKS-40
3. Analysis of an organic compound and preparation of suitable derivative-30M
4. Viva questions = 10 M

TOTAL = 50 M



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Title of the Paper: INORGANIC & PHYSICAL CHEMISTRY

Semester: IV

Course Code	23CHET41A	Course Delivery Method	Class Room / Blended Mode
Credits	3	CIA Marks	30
No. of Lecture Hours / Week	4	Semester End Exam Marks	70
Total Number of Lecture Hours	60	Total Marks	100
Year of Introduction : 2021-22	Year of Offering: 2022-23	Year of Revision: 2022-23	Percentage of Revision: 0

Course outcomes:

At the end of the course, the student will be able to;

1. Understand concepts of boundary conditions and quantization, probability distribution, most probable values, uncertainty and expectation value
2. Application of quantization to spectroscopy.
3. Various types of spectra and their use in structure determination.

Syllabus

Course Details

Unit	Learning Units	Lecture Hours
INORGANIC CHEMISTRY		26h
I	<p>Coordination Chemistry: IUPAC nomenclature of coordination compounds, Structural and stereoisomerism in complexes with coordination numbers 4 and 6. Valence Bond Theory (VBT): Inner and outer orbital complexes. Limitations of VBT, Crystal field effect, octahedral symmetry. Crystal field stabilization energy (CFSE), Crystal field effects for weak and strong fields. Tetrahedral symmetry, Factors affecting the magnitude of crystal field splitting energy, Spectro chemical series, Comparison of CFSE for Octahedral and Tetrahedral complexes, Tetragonal distortion of octahedral geometry, Jahn-Teller distortion, square planar coordination.</p>	12h
II	<p>1. Inorganic Reaction Mechanism: Introduction to inorganic reaction mechanisms. Concept of reaction pathways, transition state, intermediate and activated complex. Labile and inert complexes, ligand substitution reactions SN^1 and SN^2, Substitution reactions in square planar complexes, Trans-effect, theories of trans effect and its applications.</p>	4h
	<p>2. Stability of metal complexes: Thermodynamic stability and kinetic stability, factors affecting the stability of metal complexes, chelate effect, determination of composition of complex by Job's method and mole ratio method.</p>	2h
	<p>3. Bioinorganic Chemistry: Metal ions present in biological systems, classification of elements according to their action in biological system. Geochemical effect on the distribution of metals, Sodium K- pump, carbonic anhydrase and carboxy peptidase. Excess and deficiency of some trace metals. Toxicity of metal ions (Hg, Pb, Cd and As), reasons for toxicity, Use of chelating agents in medicine, Cis-platin as an anti-cancer drug. Iron and its application in bio-systems, Hemoglobin, Myoglobin. Storage and transfer of iron.</p>	8h
PHYSICAL CHEMISTRY		34h
III	<p>1. Phase rule: Concept of phase, components, degrees of freedom. Thermodynamic derivation of Gibbs phase rule. Phase diagram of one component system - water system, Study of Phase diagrams of Simple eutectic systems i) Pb-Ag system, desilverisation of lead ii) NaCl-Water system, Congruent and incongruent melting point- Definition and examples for systems having congruent and incongruent melting point, freezing mixtures.</p>	6h

IV	<p>Electrochemistry: Specific conductance, equivalent conductance and molar conductance- Definition and effect of dilution. Cell constant. Strong and weak electrolytes, Kohlrausch's law and its applications, Definition of transport number, determination of transport number by Hittorf's method. Debye-Huckel-Onsagar's equation for strong electrolytes (elementary treatment only), Application of conductivity measurements- conductometric titrations. Electrochemical Cells- Single electrode potential, Types of electrodes with examples: Metal- metal ion, Gas electrode, Inert electrode, Redox electrode, Metal-metal insoluble salt- salt anion. Determination of EMF of a cell, Nernst equation, Applications of EMF measurements - Potentiometric titrations. Fuel cells- Basic concepts, examples and applications.</p>	14h
V	<p>Chemical Kinetics: The concept of reaction rates. Effect of temperature, pressure, catalyst and other factors on reaction rates. Order and molecularity of a reaction, Derivation of integrated rate equations for zero, first and second order reactions (both for equal and unequal concentrations of reactants). Half-life of a reaction. General methods for determination of order of a reaction. Concept of activation energy and its calculation from Arrhenius equation. Theories of Reaction Rates: Collision theory and Activated Complex theory of bimolecular reactions. Comparison of the two theories (qualitative treatment only). Enzyme catalysis- Specificity, factors affecting enzyme catalysis, Inhibitors and Lock & key model. Michaels- Menten equation- derivation, significance of Michaelis-Menten constant.</p>	14h

List of Reference Books

1. Text book of physical chemistry by S Glasstone
2. Concise Inorganic Chemistry by J.D. Lee
3. Advanced Inorganic Chemistry Vol-I by Satyaprakash, Tuli, Basu and Madan
4. Advanced physical chemistry by Gurudeep Raj
5. Principles of physical chemistry by Prutton and Marron
6. Advanced physical chemistry by Bahl and Tuli
7. Inorganic Chemistry by J.E. Huheey
8. Basic Inorganic Chemistry by Cotton and Wilkinson
9. A textbook of qualitative inorganic analysis by A.I. Vogel
10. Atkins, P. W. & Paula, J. de Atkin's Physical Chemistry Ed., Oxford University Press 10th Ed (2014).
11. Castellan, G. W. Physical Chemistry 4th Ed. Narosa (2004).
12. Mortimer, R. G. Physical Chemistry 3rd Ed. Elsevier: NOIDA, UP (2009).
13. Barrow, G. M. Physical Chemistry

**A.G. & S.G.SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE (AUTONOMOUS),
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SEMESTER – IV	PAPER-V	PAPER CODE : 23CHET41A
PAPER TITLE : INORGANIC & PHYSICAL CHEMISTRY		ACADEMIC YEAR-2022-23

Time: 3 hours

Maximum Marks: 70

PART- A

Answer any FIVE of the following questions.

5 X 4 = 20 M

- a) Explain Jahn-Teller distortion. L2-CO1
OR
b) Explain Structural isomerism of co-ordinated complexes. L2-CO1
- a) Describe Labile & inert complexes. L1-CO2
OR
b) Interpret Job's method for determination of composition of complex. L2-CO2
- a) Explain Thermodynamic derivation of Gibb's phase rule. L2-CO3
OR
b) Explain Phase diagram of one component system - water system. L2-CO3
- a) Describe any two conductometric titrations. L1-CO4
OR
b) Define Fuel Cells with examples and applications. L1-CO4
- a) Define enzyme catalysis? Write any three factors effecting enzyme catalysis. L2CO5
OR
b) Derive integrated rate equations for first order reaction. L2CO5

PART- B

Answer ALL the questions. Each carries TEN marks

5 X 10 = 50M

- (a). Explain Valence Bond theory with Inner and Outer orbital complexes. Write limitations of VBT. L1-CO1
(or)
(b). Define CFSE. Explain the factors affecting the magnitude of crystal field splitting energy. L1-CO1
- (a). Explain Trans effect. Explain the theories of trans effect and write any two applications of trans effect. L1-CO2
(or)

- (b). (i) Tell biological functions of Haemoglobin and Myoglobin.
(ii) Write note on use of chelating agents in medicines.L1-CO2
8. (a). Interpret Phase rule and terms involved in it. Explain phase diagram of Pb-Ag system.L2-CO3
(or)
- (b).(i) Interpret phase diagram for NaCl-water system.
(ii) Explain briefly about Freezing mixtures.L2-CO3
9. (a). Define Transport number. Write experimental method for the determination of transport number by Hittorf method.L1-CO4
(or)
- (b).(i) Define single electrode potential.
(ii) Explain four types of electrodes with examples.L1-CO4
10. (a) Summarize general methods for determination of order of a reaction.L2-CO5
(or)
- (b). Explain Collision theory and Activated complex theory of bimolecular reactions.
L2-CO5

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PRACTICAL SYLLABUS

Practical Paper – V	PAPER CODE : 23CHEP41A
Conductometric and Potentiometric Titrimetry	ACADEMIC YEAR-2022-23

30 hrs (2 h/W)

Credits: 2

Practical-Course –V

Conductometric and Potentiometric Titrimetry 50 M

Course outcomes:

At the end of the course, the student will be able to;

1. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
2. Apply concepts of electrochemistry in experiments
3. Be familiar with electro analytical methods and techniques in analytical chemistry which study an analyte by measuring the potential (volts) and/or current (amperes) in an electrochemical cell containing the analyte.

Conductometric and Potentiometric Titrimetry

50 M

1. Conductometric titration- Determination of concentration of HCl solution using standard NaOH solution.
2. Conductometric titration- Determination of concentration of CH₃COOH Solution using standard NaOH solution.
3. Conductometric titration- Determination of concentration of CH₃COOH and HCl in a mixture using standard NaOH solution.
4. Potentiometric titration- Determination of Fe (II) using standard K₂Cr₂O₇ solution.
Determination of rate constant for acid catalyzed ester hydrolysis.



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Title of the Paper: Analytical Methods in Chemistry-I

Semester: VI

Course Code	CHESET01	Course Delivery Method	Class Room / Blended Mode
Credits	3	CIA Marks	25
No. of Lecture Hours / Week	3	Semester End Exam Marks	75
Total Number of Lecture Hours	45	Total Marks	100
Year of Introduction : 2022-23	Year of Offering: 2022-23	Year of Revision: 2023-24	Percentage of Revision: 20

Course Outcomes:

Students after successful completion of the course will be able to:

CO1. Remember the basic concepts of quantitative analysis data treatment, separation techniques and analysis of water (PO7)

CO2. Acquire knowledge on the concepts quantitative analysis data treatment, separation techniques and analysis of water (PO1, PO7)

CO3. Apply the conceptual knowledge gained in the areas of quantitative analysis data treatment, separation techniques and analysis of water in the chosen job role (PO1)

CO4. Analyse that how far the quantitative methods, data treatment methods separation techniques and Analysis of water (PO1).

Syllabus**Course Details**

Unit	Learning Units	Lecture Hours
I	Quantitative analysis-1: 1. A brief introduction to analytical methods in chemistry 2. Principles of volumetric analysis, concentration terms- Molarity, Normality, v/v, w/v, ppm and ppb, preparing solutions- Standard solution, primary standards and secondary standards. 3. Description and use of common laboratory apparatus- volumetric flask, burette, pipette, beakers, measuring cylinders.	8hrs
II	Quantitative analysis-2 1. Principles of volumetric analysis: Theories of acid-base (including study of acid-base titration curves), redox, complexometric, iodometric and precipitation titrations-choice of indicators for the saturations. 2. Principles of gravimetric analysis: precipitation, coagulation, peptization, co-precipitation, post precipitation, digestion, filtration, and washing of precipitate, drying and ignition.	12 Hrs
III	Treatment of analytical data Types of errors- Relative and absolute, significant figures and its importance, accuracy – methods of expressing accuracy, errors- Determinate and indeterminate and minimization of errors, precision- methods of expressing precision, standard deviation and confidence interval.	8 Hrs
IV	Separation techniques: 1. Solvent Extraction: Introduction, principle, techniques, factors affecting solvent extraction, Batch extraction, continuous extraction and counter current extraction. Synergism. Application-Determination of Iron (III). 2. Ion Exchange method: Introduction, action of ion exchange resins, applications	5 Hrs
V	Spectrophotometry Principle, Instrumentation: Single beam and double beam spectrometer, Beer- Lambert's law- Derivation and deviations from Beer-Lambert's law, applications of Beer- Lambert's law-Quantitative determination of Fe^{+2} , Mn^{+2} and Pb^{+2} . Determination of PK value of indicator, determination of Glucose in blood.	12Hrs

III References

1. Analytical Chemistry by Gary D.Christian, Purnendu K.Dasgupta and Kevin A.Schug, Seventh edition, Wiley.
2. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
3. Text book of Environmental Chemistry and Pollution Control by S.S.Dara and D.D.Mishra, Revised edition, S Chand & Co Ltd.

Text Books:

1. Instrumental methods of chemical analysis by B K Sharma
2. Separation methods MN Sastry

Reference materials on the web/web links:

1. [https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Supplemental_Modules_\(Analytical_Chemistry\)/Quantifying_Nature/Volumetric_Chemical_Analysis_\(Shiundu\)/14.1%3A_Sampling_and_Statistical_Analysis_of_Data](https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Supplemental_Modules_(Analytical_Chemistry)/Quantifying_Nature/Volumetric_Chemical_Analysis_(Shiundu)/14.1%3A_Sampling_and_Statistical_Analysis_of_Data)
2. <https://vlab.amrita.edu/?sub=2&brch=190&sim=338&cnt=1>

IV Co-Curricular Activities:

a) Mandatory (Lab/field training of students by teacher (lab: 10 + field: 05) :

1.For Teacher: Training of students by the teacher in laboratory and field for not less than 15 hours on the field techniques/skills of calibration of pH meter, Strong acid vs strong base titration using pH meter, determination of chloride ion, estimation of water quality parameters and estimation of Iron(II).

Google classroom created during instruction of course by the teacher concerned for sharing relevant material and conducting exams.

2. For Student: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe. Write their observations and submit a hand written fieldwork/project work report not exceeding 10 pages in the given format to the teacher.

3. Max marks for Fieldwork/project work Report: 05.

4. Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.

5. Unit tests (IE).

b) Suggested Co-Curricular Activities

1. Training of students' by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics).
3. Visits to facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

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Model Paper

SEMESTER – V	PAPER CODE:CHESET01
PAPER TITLE : Analytical Methods in Chemistry-I ACADEMIC YEAR-2023-2024	

Time: 3Hours

Maximum marks: 75

Minimum marks: 30

SECTION-A

Answer any Five questions. Each carries 5 marks.

5X5=25M

1. Explain the preparation of v/v based with suitable examples-L2
2. Discuss the significance of quantitative analysis in Chemistry-L2
3. Explain the need of drying the precipitate in gravimetric analysis-L2
4. Discuss the principal involved in Idometric titrations-L2
5. Define accuracy and explain the methods of expressing accuracy-L2
6. Discuss the principal and theory involved in solvent extraction-L1
7. Illustrate the importance of significant figures in qualitative analysis-L3
8. Explain the quantitative determination of Pb^{+2} by spectrophotometric methods-L3

SECTION-B (Total: 5x10=50 Marks)

9(a) Discuss the detail about the primary and secondary standards with suitable examples-L2

Or

(b) Describe the role of the following apparatus in analytical chemistry I) Volumetric flask II) Burette III) Pipette –L2

10(a) Elaborate the theory involved in complexometric and acid base titrations-L2

Or

(b) Write a note on the following terms in gravimetric analysis I) Precipitation II) Digestion III) Filtration-L2

11(a) Define error, discuss in detail about various types of errors encountered in quantitative analysis-L2

Or

(b) Elaborate the methods used for minimization of errors-L2

12(a) Discuss the various factors which effect solvent extraction-L2

Or

(b) Explain in detail about role of Ion exchange resins in separation of compounds-L2

13(a) Explain the role of spectrophotometry in the determination of PK value of an indicator-L2

Or

(b) Give a detailed account on various factors responsible for deviation from Beer's- Lambert's law-L2

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PRACTICAL SYLLABUS

Practical Paper – V Analytical methods in chemistry-I Practical syllabus	PAPER CODE : CHESEP01 ACADEMIC YEAR-2023-2024
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30 hrs (2 h/W)

Credits: 2

I Learning Outcomes: On successful completion of this practical course, student shall be able to:

CO1. Estimate Iron (II) using standard Potassium dichromate solution (PO1)

CO2. Learn the procedure for the estimation of total hardness of water (PO7)

CO3. Demonstrate the determination of chloride using Mohr’s method (PO1, PO7)

CO4. Acquire skills in the operation and calibration of pH meter (PO1)

II Practical (Laboratory) Syllabus :(30hrs)

1. Estimation of Iron(II) using standard Potassium dichromate solution (using DPA indicator)
2. Estimation of total hardness of water using EDTA
3. Determination of chloride ion by Mohr’s method
4. Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetate and their mixtures.
5. Preparation of buffer solutions of different pH (i) Sodium acetate-acetic acid, (ii) Ammonium chloride-ammonium hydroxide.
6. pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base.
7. Determination of dissociation constant of a weak acid.

II Lab References:

1. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.

SCHEME OF VALUATION

1. INTERNAL MARKS- Record-10M

2. EXTERNAL MAKS-40

Practical -30M

Viva questions = 10 M

TOTAL = 50 M



A.G. & S.G.SIDDHARTHA DEGREE COLLEGE OF ARTS & SCIENCE

(AUTONOMOUS), VUYYURU.

NAAC reaccredited at "A" level

Autonomous -ISO 9001 – 2015 Certified

Title of the Paper: Analytical Methods in Chemistry-2

Semester: V

Course Code	CHESET02	Course Delivery Method	Class Room / Blended Mode
Credits	3	CIA Marks	25
No. of Lecture Hours / Week	3	Semester End Exam Marks	75
Total Number of Lecture Hours	45	Total Marks	100
Year of Introduction : 2022 - 23	Year of Offering: 2022- 23	Year of Revision: -----	Percentage of Revision: 0

Learning Outcomes: Students after successful completion of the course will be able to:

- **CO1.** Remember the basic concepts of Chromatography like paper, TLC, Column, GC & HPLC (PO7)
- **CO2.** Understand the significance of paper, TLC, Column, GC & HPLC in separation and identification of compounds (PO1, PO7) .
- **CO3.** Apply the conceptual knowledge gained in the techniques of chromatography in separating and identifying the chemical compounds as and when required (PO1).
- **CO4.** Analyse that how far one chromatographic technique is much use full in separation and identification of compounds over the other chromatographic technique (PO1, PO7).

Syllabus

Course Details

Unit	Learning Units	Lecture Hours
I	<p>Chromatography-Introduction and classification:</p> <p>Principle, Classification of chromatographic methods, Nature of adsorbents, eluents, R_f values, factors affecting R_f values.</p>	7 hr
II	<p>TLC and paper chromatography:</p> <p>1. Thin layer chromatography: Principle, Experimental procedure, preparation of plates, adsorbents and solvents, development of chromatogram, detection of spots, applications and advantages.</p> <p>2. Paper Chromatography: Principle, Experimental procedure, choice of paper and solvents, various modes of development- ascending, descending, radial and two dimensional, applications.</p>	12 hr
III	<p>Column chromatography:</p> <p>1. Column chromatography: Principle, classification, Experimental procedure, stationary and mobile phases, development of the Chromatogram, applications, factors affecting the column efficiency.</p> <p>2. Applications:- Separation of Methylene Blue and Fluorene by column chromatography.</p>	10 Hr
IV	<p>Gas chromatography:</p> <p>Basic principles. Different types of GC techniques. Selection of columns and carrier gases. Instrumentation. Detectors-Thermal conductivity detector, Flame ionization detector, R_f values. Applications in the separation of amino acids & estrogens</p>	8 hr
V	<p>High Performance liquid chromatography (HPLC)</p> <p>Basic principles. Normal and reversed Phases. Selection of column and mobile phase. Instrumentation. Detectors- RID, UV detector R_f values. Applications in</p>	8 Hr

	the separation, separation of anions, barbiturates, tropane alkaloids.	
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III References

1. Fundamental so Analytical Chemistry by F. James Holler, Stanley R Crouch, Donald M. West and Douglas A. Skoog, Ninth edition, Cengage.
2. Analytical Chemistry by Gary D. Christian, Purnendu K. Dasgupta and Kevin A. Schug, Seventh edition, Wiley.
3. Quantitative analysis by R. A. Day Jr. and A. L. Underwood, Sixth edition, Pearson.
4. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition/ Pearson.

Text Books:

1. Instrumental methods of chemical analysis by B K Sharma
2. Instrumental methods of chemical analysis by Gurudeep & Chatwal Anand

Reference materials on the web/web links:

1. [https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Supplemental_Modules_\(Analytical_Chemistry\)/Instrumental_Analysis/Chromatography/Gas_Chromatography](https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/Supplemental_Modules_(Analytical_Chemistry)/Instrumental_Analysis/Chromatography/Gas_Chromatography)
2. <https://lab-training.com/hplc-high-performance-liquid-chromatography/>

VI Co-Curricular Activities:

a) Mandatory : (Lab/field training of students by teacher (lab: 10+ fields: 05):

1. For Teacher: Training of students by the teacher in laboratory and field for not less than 15 hours on the field techniques/skills of determination of hardness of water, using the calorimeter and or Spectrophotometer, preparation of TLC plate, identification of spots in TLC and Paper chromatographic techniques, loading of column, selection of solvent system, separation of amino acids and dyes mixture using chromatographic techniques.

Google classroom created during instruction of course by the teacher concerned for sharing relevant material and conducting exams.

2. For Student: Student shall visit a related industry/chemistry laboratory in universities/research organizations/private sector facility and observe the chromatographic techniques used for the separation of compounds. Write their observations and submit a hand written fieldwork/project work report not exceeding 10 pages in the given format to the teacher.

3. Max marks for Fieldwork/project work Report: 05.

4. Suggested Format for Fieldwork/project work: Title page, student details, index page, details of place visited, observations, findings, and acknowledgements.

5. Unit tests (IE).

b) Suggested Co-Curricular Activities

1. Training of students by related industrial experts.
2. Assignments, Seminars and Quiz (on related topics).
3. Visits to facilities, firms, research organizations etc.
4. Invited lectures and presentations on related topics by field/industrial experts.

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Model Paper

SEMESTER – V	PAPER-V	PAPER CODE : CHESET02
PAPER TITLE : Analytical Methods in Chemistry-2 ACADEMIC YEAR-2023-2024		

Time: 3Hours

Maximum marks: 75

Minimum marks: 25

SECTION-A

Answer any Five questions. Each carries 5 marks.

5X5=25M

- 1) What is the basic principle involved in chromatography, explain nature of adsorbents-L1
- 2) How to prepare TLC plates-L3
- 3) Explain Ascending and descending techniques in paper chromatography-L2
- 4) Explain the classification of column chromatography-L2
- 5) Write briefly about experimental procedure for column chromatography-L2
- 6) Explain the schematic diagram of G.C-L2
- 7) Explain schematic diagram of HPLC-L2
- 8) Write experimental procedure of TLC.-L2

SECTION-B

5x10=50 M

- 9 (a) How do the chromatographic methods are classified? Explain any one-L2
Or
(b) Define Rf value, Explain factors effecting the Rf values-L2
- 10 (a) Discuss the applications of TLC.-L3
Or
(b) Explain the applications of paper chromatography-L3
- 11(a) Explain the factors effecting the column efficiency in CC-L2
Or
(b) Discuss the separation of methylene blue and fluorescein by C C.-L2
- 12 (a) Explain different types detectors used in G.C-L2.
Or
(b) Explain the separation of Amino acids by G.C-L2
- 13 (a) Explain the different detectors used in HPLC-L2
Or
(b) Explain the separation of Anions and Barbiturates by HPLC-L2

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PRACTICAL SYLLABUS

Practical Paper – V Analytical methods in chemistry-2 Practical syllabus	PAPER CODE : CHESEP02 ACADEMIC YEAR-2023-2024
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I. Learning Outcomes: On successful completion of this practical course, student shall be able to:

CO1. Perform the separation of a given dye mixture using TLC (PO1)

CO2. Learn the preparation of TLC plates (PO1, PO7)

CO3. Demonstrate the separation of mixture of amino acids using paper chromatography (PO1)

CO4. Acquire skills in using column chromatography for the separation of dye mixture (PO7)

II .Practical (Laboratory) Syllabus: (30hrs)

1. Separation of a given dye mixture (methyl orange and methylene blue) using TLC (using alumina as adsorbent).
2. Separation of different amino acids using paper chromatography.
3. Separation of given mixture of amino acids (glycine and phenyl alanine) using ascending paper chromatography.
4. Estimation of Fe^{+2} by using thiocyanate by calorimeter.
5. Separation of sugars using TLC
6. Verification of Beer lambert's law. (Using potassium permanganate solution) using colorimeter /spectrophotometer.

III Lab References:

1. **Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.**
2. Vogel A. I. Practical Organic Chemistry, Longman Group Ltd.
3. Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley- Eastern.
4. Ahluwalia V. K. and Aggarwal R. Comprehensive Practical Organic Chemistry, University press.
5. Mann F.Gand Saunders B.C, Practical Organic Chemistry, Pearson Education.

SCHEME OF VALUATION

1. INTERNAL MARKS- Record-10M
2. EXTERNAL MARKS-40
 - Practical-30M
 - Viva questions = 10

TOTAL = 50 M