**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) EVEN SEM BOS (2&4)

## Academic year 2024-2025

Date : 10-02-2025

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

**Minutes of the Meeting of Board of Studies in Chemistry held at 11.30 A.M on 10-02-2025 in the Department of Chemistry through online mode.**

*Dr .G.Giriprasad* *Presiding*

**Members Present:**

| | |
|---|---|
| 1)…….. (Dr. G.Giri Prasad ) | Chairman., Head, Dept. of Chemistry, A.G. & S.G.S. Degree College,Vuyyuru. |
| 2)…….. (Dr. A.Rama Rao) | University Nominee, Assistant Professor, Dept. of Chemistry, P.B Siddhartha College of Arts and Sciences., Vijayawada |
| 3)…… (Proff. Venkata Nadh Ratnakaram) | Academic Council Nominee., GITAM School of Science, GITAM Deemed to be University Bengaluru Campus, Karnataka |
| 4)…… (Dr. K. V.S. Koteswara Rao) | Academic Council Nominee., Lecturer in Chemistry, SRK., GDC, Vinukonda, |
| 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.Santhi) | Member., Lecturer in Chemistry, A.G. & S.G.S.Degree College,Vuyyuru |
| 8)…… (Sri. P.Suresh) | Member Lecturer in Chemistry, A.G. & S.G.S.Degree College,Vuyyuru. |
| 9)…… (MS. M.Santhi) | 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. |

**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 2024-2025.
2. To recommend the syllabus and model papers for IV semester of II Degree B.Sc., Chemistry Major & Minor for the Academic year 2024-2025.
3. To recommend the Value Added Course for IV semester of II Degree B.Sc., Chemistry Major students for the Academic year 2024-2025.
4. To recommend the Guidelines to be followed by the question paper setters in Chemistry for II, IV 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 2024--2025.
    - Major Chemistry Title :1. **GENERAL AND INORGANIC CHEMISTRY**
      **Practical Paper :** Qualitative inorganic analysis (Minimum of Six simple salts should be analyzed)
    - 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 analyzed)
    - 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** Chemistry Major & Minor for the Academic year 2024--2025.
    - Major Chemistry title 1 : Physical Chemistry-II (States of matter ,Phase rule & Surface Chemistry)
    - Practical paper : Physical Chemistry-II Practical
    - Major Chemistry title 2 : General and Physical Chemistry
    - Practical paper : Physical Chemistry-Volumetric Analysis
    - Major Chemistry title 3 : Nitrogen Containing Organic Compounds & Spectroscopy
    - Practical paper : Organic Preparations and IR Spectral Analysis
    - Minor Chemistry title 1 : Physical Chemistry-II (States of matter ,Phase rule & Surface Chemistry)
    - Practical paper : Physical Chemistry-II Practical
    - Minor Chemistry title 2 : General and Physical Chemistry
    - Practical paper : Physical Chemistry-Volumetric Analysis
3. It is resolved to follow the Value added course for the Academic year 2024—2025. For second majo chemistry students
    - Topic : Water Analysis
4. It is resolved to follow the **guidelines** to be followed by the question paper setters of Chemistry for II, IV semesters of Degree B.Sc. Major & Minor students for the Academic Year 2024-2025.
5. It is resolved to continue the following teaching and evolution methods for Academic year 2024-25.

**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 30marks, 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).
- 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 B.Sc.

**Semester – End Examination:**

➢ The maximum marks for II, IV,B.Sc Semester – End examination shall be 70/70 marks 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 and the result shall be declared as "PASS".

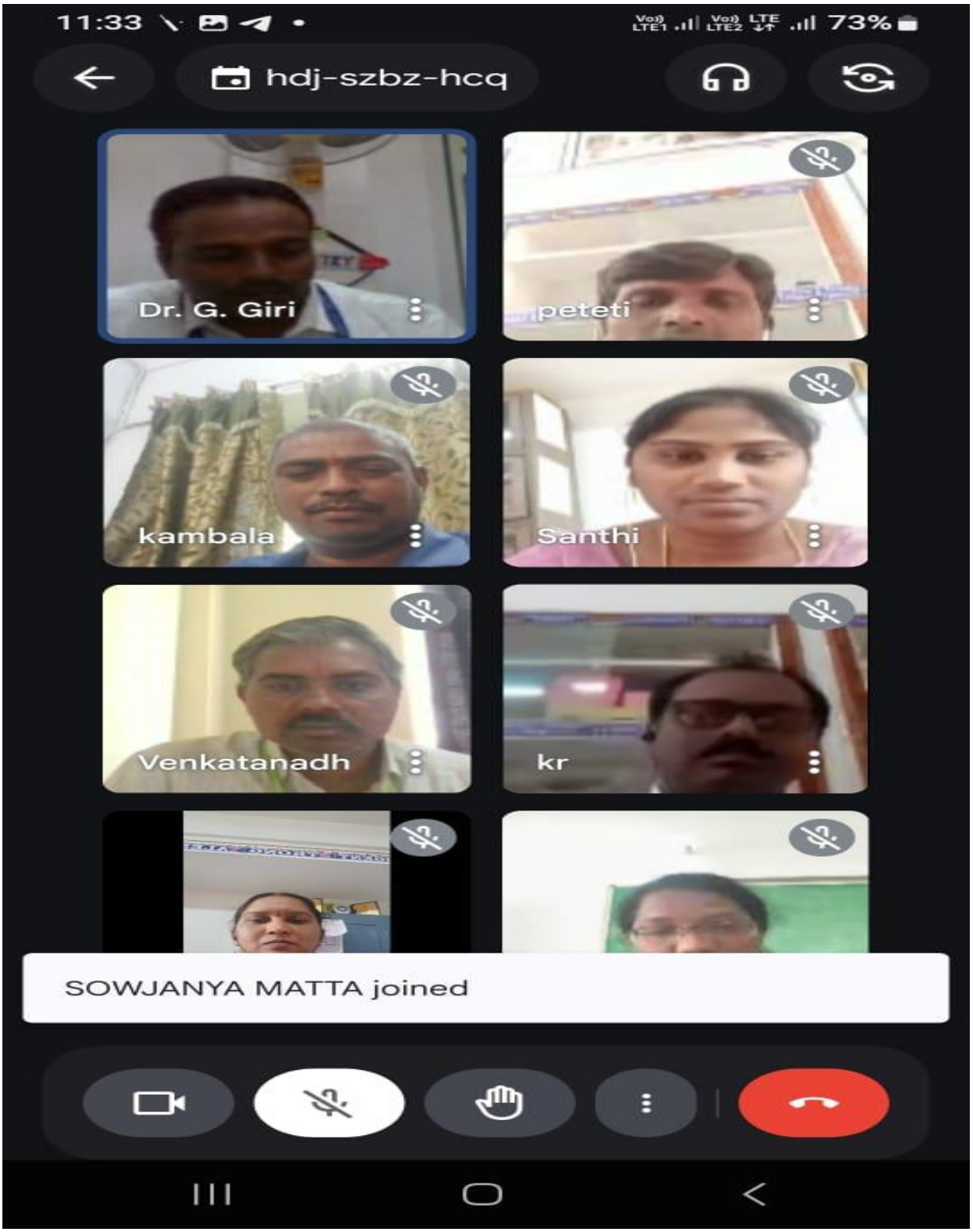
➢ Semester – End examinations shall be conducted in theory papers at the end of every semester, while in practical papers, these examinations are conducted at the end of II,IV semesters for I, II B.Sc for 50 marks.

**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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# 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: 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 | **3** | Semester End Exam Marks | **70** |
| Total Number of Lecture Hours | **60** | Total Marks | **100** |
| Year of Introduction : 2023-24 | Year of Offering: 2024-25 | Year of Revision: 2024-25 | 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 theperiodic 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** | **Atomic Structure and Periodic table:** Electronic configuration: Bohr theory, duel 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).<br>**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. | **9h** |
| **II** | **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 $\Delta H_f$ 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. | **9h** |
| **III** | **The Covalent Bond:** Valance 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-$NH_3$, $H_2O$, $SF_4$, $ICl^{-4}$, $ICl^{-2}$, $XeF_4$, $XeF_6$.<br>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). | **9h** |
| **IV** | **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**.** | **9h** |
| **V** | **Acids and Bases:**<br>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.<br>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. | **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. Freemanand Co, London

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

| SEMESTER – II PAPER-II | **PAPER CODE :** 23CHMAL121<br>**ACADEMIC YEAR-2024-25** |
|---|---|
| **GENERAL AND INORGANIC CHEMISTRY** | |

**Time: 3 hours** **Maximum Marks: 70**

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**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. **LI -CO2**

**Or**

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

3. a)Explain about Valance 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 duel 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 NH3, XeF4, XeF6 **L1-CO3**

**Or**

(b). Construct the M.O. diagrams for N2 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).Difine 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<br>ACADEMIC YEAR-2024-25 |
|---|---|

**30 hrs (2h/w)** **Credits-1**

## Practical- I

## Qualitative Analysis of Simple Salt

Qualitative inorganic analysis (Minimum of Six simple salts should be analyzed) **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 inthe laboratory
3. Apply the concepts of common ion effect, solubility product and concepts relatedto qualitative analysis

**Syllabus**

**Analysis of SimpleSalt** **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 Quanlitative Inorganic Analysis, Seventh edition, Pearson

SCHEME OF VALUATION

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

TOTAL = 50 M

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**Autonomous -ISO 9001 – 2015 Certified**

**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 | **3** | Semester End Exam Marks | **70** |
| Total Number of Lecture Hours | **60** | Total Marks | **100** |
| Year of Introduction : 2023-24 | Year of Offering: 2024-25 | Year of Revision: 2024-25 | 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** | **Chemistry of p-block elements**<br>Group13: Preparation & structure of Diborane, Borazine and $(BN)_x$<br>Group14:Preparation, classification and uses of silicones and Silanes.<br>Group 15:Preparation & structure of Phosphonitrilic Chloride $P_3N_3Cl_6$. | **9h** |
| **II** | **Chemistry of p-block elements – II:**<br>Group 16: Classification of Oxides, structures of oxides and Oxoacids of Sulphur Group 17: Preparation and Structures of Interhalogen compounds. Pseudohalogens, | **9h** |
| **III** | **Chemistry of d-block elements:**<br>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. | **9h** |
| **IV** | **Chemistry of f-block elements:**<br>Chemistry of lanthanides - electronic configuration, oxidation states, lanthanide contraction, consequences of lanthanide contraction, colour, magnetic properties. Separation of lathanides by ion exchange method.<br>Chemistry of actinides - electronic configuration, oxidation states, actinide contraction, comparison of lanthanides and actinides. | **9h** |
| **V** | **Radioactivity**<br>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. | **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-2024-25** |
|---|---|
| **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. **LI -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), VUYYURU.**
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**PRACTICAL SYLLABUS**

| INORGANIC CHEMISTRY-I | PAPER CODE : 23CHMAP122<br>ACADEMIC YEAR-2024-25 |
|---|---|

**30 hrs (2h/w)** **Credits-1**

**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.

# 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: GENERAL AND INORGANIC CHEMISTRY**

**Semester: II**

| **Course Code** | 23CHMIL121 | **Course Delivery Method** | **Class Room / Blended Mode** |
|---|---|---|---|
| Credits | **3** | CIA Marks | 30 |
| No. of Lecture Hours / Week | **3** | Semester End Exam Marks | **70** |
| Total Number of Lecture Hours | **60** | Total Marks | **100** |
| Year of Introduction : 2023-24 | Year of Offering: 2024-25 | Year of Revision: 2024-25 | 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 theperiodic 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** | **Atomic Structure and Periodic table:** Electronic configuration: Bohr theory, duel 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).<br>**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. | **9h** |
| **II** | **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 $\Delta H_f$ 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. | **9h** |
| **III** | **The Covalent Bond:** Valance 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-$NH_3$, $H_2O$, $SF_4$, $ICl^{-4}$, $ICl^{-2}$, $XeF_4$, $XeF_6$.<br>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). | **9h** |
| **IV** | **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**.** | **9h** |
| **V** | **Acids and Bases:**<br>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.<br>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. | **9h** |

**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. Freemanand Co, London

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

| SEMESTER – II PAPER-II | **PAPER CODE :** 23CHMIL121<br>**ACADEMIC YEAR-2024-25** |
|---|---|
| **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. **LI -CO2**

**Or**

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

3. a)Explain about Valance 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 duel 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 NH3, XeF4, XeF6 **L1-CO3**

**Or**

(b). Construct the M.O. diagrams for N2 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).Difine 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-2024-25 |
|---|---|

**30 hrs (2h/w)** **Credits-1**

**Practical- I**

**Qualitative Analysis of Simple Salt**

Qualitative inorganic analysis (Minimum of Six simple salts should be analyzed) **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 inthe laboratory
6. Apply the concepts of common ion effect, solubility product and concepts relatedto qualitative analysis

**Syllabus**

**Analysis of SimpleSalt** **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 Quanlitative Inorganic Analysis, Seventh edition, Pearson

SCHEME OF VALUATION

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

TOTAL = 50 M

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**Vuyyuru-521165**

**NAAC reaccredited at "A" level**

**Autonomous -ISO 9001 – 2015 Certified**

**Title of the Paper: Physical chemistry –II (States of Matter, Phase rule &Surface Chemistry)**

**Semester: IV**

| **Course Code** | **23CHMAL241** | **Course Delivery Method** | **Class Room / Blended Mode** |
|---|---|---|---|
| Credits | **3** | CIA Marks | 30 |
| No. of Lecture Hours / Week | **3** | Semester End Exam Marks | **70** |
| Total Number of Lecture Hours | **60** | Total Marks | **100** |
| Year of Introduction : 2024-25 | Year of Offering: 2024-25 | Year of Revision: 2024-25 | Percentage of Revision: 100 |

**COURSE DESCRIPTION:**

Physical Chemistry II, focusing on the **States of Matter**, **Phase Rule**, and **Surface Chemistry**, provides a deeper understanding of the behavior of matter at the molecular and macroscopic levels. Building on the fundamental principles of thermodynamics and kinetics, this course explores the physical characteristics and transitions of matter, the application of the Phase Rule to complex systems, and the unique properties of surfaces in various chemical processes

| S.NO | COURSE OBJECTIVES |
|---|---|
| **1** | To explore and comprehend the basic principles governing the three main states of matter (solid, liquid, and gas), To introduce the **Phase Rule** and its application to single and multi-component systems in equilibrium |
| **2** | To study the properties of matter in different states, including the concept of intermolecular forces and the behavior of gases, liquids, and solids, To understand the concept of **degrees of freedom**, **phase diagrams**, and **coexistence of phases** in various systems. |
| **3** | To analyze the relationship between temperature, pressure, and volume in the context of gas laws (Ideal Gas Law, Van der Waals equation, etc.) To study the phase transitions (e.g., fusion, vaporization, sublimation) and the relationship between the phases (solid, liquid, gas) in different thermodynamic systems. |

| | |
|---|---|
| **4** | To gain insights into the behavior of real gases and the factors affecting their deviation from ideal gas behavior, To apply the Phase Rule to complex systems such as binary mixtures, colligative properties, and critical phenomena. |
| **5** | To interpret phase diagrams and calculate the number of independent variables for different types of systems. To examine the structure and properties of surfaces, including **adsorption** and **desorption** phenomena, and the factors affecting these processes. |

**Course Aims and Ob**

**Course outcomes:**

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

| CO NO | COURSE OUTCOME | BTL | PO | PSO |
|---|---|---|---|---|
| **CO1** | Remember and Explain the difference between solids liquids and gases in terms of intermolecularinteractions. | **K1** | **PO2** | **PSO1** |
| **CO2** | Understand and apply surface chemistry principles to practical scenarios, such as catalysis, adsorption, and colloid stability. | **K1** | **PO2** | **PSO1** |
| **CO3** | Apply basic concepts of two component systems | **K2** | **PO2** | **PSO1** |
| **CO4** | Analyze phase diagrams and calculate degrees of freedom. | **K2** | **PO7** | **PSO2** |
| **CO5** | Evaluate the concepts of adsorption and Apply the Phase Rule to understand the equilibria in multi-component systems. | **K3** | **PO1** | **PSO2** |

**For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create**

| CO-PO MATRIX | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **CO NO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PSO1** | **PSO2** |
| **CO1** | | **1** | | | | | | **2** | |
| **CO2** | | **1** | | | | | | **2** | |
| **CO3** | | **2** | | | | | | **2** | |
| **CO4** | | | | | | | **2** | | **2** |
| **CO5** | **2** | | | | | | | | **2** |

**Use the codes 3,2,1 for high, moderate and low correlation between co-po-pso respectively**

## Syllabus

**Course Details**

| Unit | Learning Units | Lecture Hours |
|---|---|---|
| **Physical chemistry –II (States of Matter, Phase rule &Surface Chemistry)** | | |
| **I** | **Unit I - Gaseous state**<br>Postulates of Kinetic theory of Gases (exclude derivation) – deduction of gas laws from kinetic gas equation-Vander Waal's equation of state. Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. Relationship between critical constants and vander Waal's constants. Law of corresponding states. Joule- Thomson effect. Inversion temperature. | **9Hrs** |
| **II** | **Unit II – Liquid State**<br>Physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity, and their determination. Effect of addition of various solutes on surface tension and viscosity. Temperature variation of viscosity of liquids and comparison with that of gases. Qualitative discussion of structure of water.<br>Liquid crystals, mesomorphic state. Differences between liquid crystal and solid/liquid. Classification of liquid crystals into Smectic and Nematic. Application of liquid crystals as LCD devices | **9Hrs** |
| **III** | **UNIT-III - Solid state**<br>Symmetry in crystals. Law of constancy of interfacial angles. The law of rationality of indices. Miller indices, Definition of lattice point, space lattice, unit cell. Bravais lattices and crystal systems. X-ray diffraction and crystal structure. Bragg's law and its derivation. Powder method. Defects in crystals. Stoichiometric and non-stoichiometric defects. | **9Hrs** |
| **IV** | **Unit IV - Phase Rule**<br>The Concept of phase, components, degrees of freedom. Gibbs phase rule. Phase diagram of one component system – water system, Study of Phase diagrams of Simple eutectic systems<br>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 | **9Hrs** |
| **V** | **Unit V Surface Chemistry**<br>Definition and classification of Colloids- Coagulation of colloids- Hardy-Schulze rule.Stability of colloids, Protection of Colloids, Gold number.<br>Adsorption -Physical and chemical adsorption, Freundlich and Langmuir adsorptionisotherm, applications of adsorption. | **9Hrs** |

## I. List of Reference Books:


1) Solid State Chemistry and its applications by Anthony R. West
2) Text book of physical chemistry by K L Kapoor Vol.1
3) Text book of physical chemistry by S Glasstone
4) Advanced physical chemistry by Bahl and Tul


Web links :

https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/DeVoes_Thermodynamics_and_Chemistry/02%3A_Systems_and_Their_Properties/2.02%3A_Phases_and_Physical_States_of_Matter

http://www.gcekjr.ac.in/pdf/lectures/2020/6606-_2nd%20Semester_ALL.pdf

https://www.studiestoday.com/worksheets/447/chemistry.html

https://www.mlsu.ac.in/econtents/1210_surfacechemistrytutornotes-190628091806.pdf

https://www.nios.ac.in/media/documents/SrSec313NEW/313_Chemistry_Eng/313_Chemistry_Eng_Lesson6.pd

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**Vuyyuru-521165**

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**Autonomous -ISO 9001 – 2015 Certified**

**Title of the Paper: Physical chemistry –II (States of Matter, Phase rule &Surface Chemistry)**

**Semester: IV**

## INTERNAL ASSESMENT QUESTION PAPER

| | | |
|---|---|---|
| **SET No** | **1** | |
| **Course Code :**<br>**Title of the Course:** | **23CHMAL241**<br>**PHYSICAL CHEMISTRY –II**<br>(States of Matter, Phase Rule & Surface Chemistry | |
| **Offered to:** | **BSc Hons Chemistry** | |
| **Category:** | **SEMESTER** | **3** |
| **Max. Marks for IA** | **30** | |
| **Max.Time** | **90 Min** | |

### Section A: Short Answer Questions (10 Marks)

**Answer all questions. Each question carries 5 Marks.**

Q1 (a) Describe Joule- Thomson effect. K1

OR

(b) Discuss Vander Waal's equation of state.. K1

Q2 (a) Explain Differences between liquid crystal and solid/liquid. K2

OR

(b) Describe Physical properties of liquids. K2

### Section B: Long Answer Questions (20 Marks)

**Answer All questions. Each question carries 10 Marks.**

Q3 (a) Illustrate Andrew's isotherms of carbon dioxide K3

OR

(b) Give Relationship between critical constants and vander Waal's constants. K3

Q4 (a) Classify liquid crystals. And give its applications K3

OR

(b) Explain Effect of addition of various solutes on surface tension and viscosity K3

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**Title of the Paper: Physical chemistry –II (States of Matter, Phase rule &Surface Chemistry)**

**Semester: IV**

**SEMESTER -END QUESTION PAPER**

| | |
|---|---|
| **Course Code & Title of the Course:** | **23CHMAL241**<br>**PHYSICAL CHEMISTRY –II**<br>States of Matter, Phase Rule & Surface Chemistry |
| **Offered to:** | **BSc Hons Chemistry** |
| **Category:** | **SEMESTER: III** |
| **Max. Marks** | **70** |
| **Max.Time** | **3 Hrs** |

**Section A: Short Answer Questions (20 Marks)**
**Answer all questions. Each question carries 4 Marks.**

| | | |
|---|---|---|
| Q1 | (a) Discuss Vander Waal's equation of state. | K1 |
| | OR | |
| | (b) Describe Joule- Thomson effect. | K1 |
| Q2 | (a) Explain Differences between liquid crystal and solid/liquid | K1 |
| | OR | |
| | (b) Describe Physical properties of liquids. | K1 |
| Q3 | (a) Describe Law of constancy of interfacial angles | K2 |
| | OR | |
| | (b) Explain Stoichiometric and non-stoichiometric defects | K2 |
| Q4 | (a) Explain phase, components, degrees of freedom. | K2 |
| | OR | |
| | (b) Explain the Gibbs phase rule | K2 |
| Q5 | (a) Illustrate Physical and chemical adsorption | K3 |
| | OR | |
| | (b) Give the definition and classification of Colloids | K3 |

**Section B: Long Answer Questions (50 Marks)**

**Answer all questions. Each question carries 10 Marks.**

**Answer all questions. Each question carries 10 Marks.**

Q6 (a) Describe Andrew's isotherms of carbon dioxide K1

OR

(b) Discuss Relationship between critical constants and vander Waal's constants. K1

Q7 (a) Classify liquid crystals. And give its applications

OR

(b) Explain Effect of addition of various solutes on surface tension and viscosity K2

Q8 (a) Interpret X-ray diffraction and crystal structure. Bragg's law and its derivation K3

OR

(b) Give note on law of rationality of indices. Miller indices, Definition of lattice point K3

Q9 (a) Draw and discuss Phase diagrams of Pb-Ag system, desilverisation of lead K3

OR

(b) Draw and discuss Phase diagrams of NaCl-Water system, K3

Q10 (a) Interpret Coagulation of colloids- Hardy-Schulze rule and Gold number. K3

OR

(b) Explain Freundlich and Langmuir adsorptionisotherm K3

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**Title of the Paper: Physical chemistry –II (States of Matter, Phase rule &Surface Chemistry)**

**Semester: IV**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | | | | **23CHMAP241** | | | |
| **Title of the Course** | | | | **PHYSICAL CHEMISTRY –II** | | | |
| **Offered to: (Programme/s)** | | | | B.Sc. Hons Chemistry | | | |
| **L** | **0** | **T** | **0** | **P** | **2** | **C** | **1** |
| **Year of Introduction:** | | **2024-25** | | **Semester:** | | | **IV** |
| **Course Category:** | | **MAJOR** | | **Course Relates to:** | | **GLOBAL** | |
| **Year of Revision:** | | **2024** | | **Percentage:** | | **NA** | |
| **Type of the Course:** | | | | Employability,skill | | | |
| **Crosscutting Issues of the Course :** | | | | Environment and Sustainability | | | |
| **Pre-requisites, if any** | | | | | | | |

**COURSE DESCRIPTIONS:**

This course provides an in-depth understanding of the fundamental principles of physical chemistry, with a focus on surface tension, viscosity, and adsorption. Through hands-on laboratory experiments, students will learn to measure and analyze physical properties of liquids and mixtures using modern experimental techniques. The course emphasizes the practical application of theoretical concepts, offering insights into the interplay of molecular interactions, surface phenomena, and bulk properties in real-world systems.

**Course Aims and Objectives:**

| S.NO | COURSE OBJECTIVES |
|---|---|
| **1** | To familiarize students with experimental techniques for determining surface tension using drop count and drop weight methods. |
| **2** | To understand the principles of fluid viscosity and its role in various chemical and physical systems. |
| **3** | To apply theoretical principles with practical applications in industries such as detergents, pharmaceuticals, and materials science.. |
| **4** | To foster critical thinking by analyzing experimental outcomes and comparing them with theoretical expectations. |
| **5** | To gain a comprehensive understanding of surface and interfacial phenomena, fluid dynamics, and adsorption, as well as the skills to apply these concepts effectively in scientific and industrial contexts. |

**Course outcomes:**

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

| CO NO | COURSE OUTCOME | BTL | PO | PSO |
|---|---|---|---|---|
| CO1 | Use glassware, equipment and chemicals and follow experimental procedures in thelaboratory | K1 | PO1 | PSO1 |
| CO2 | Understand and familiar with the concepts & practical applications of Surface tension and viscosityof liquids | K1 | PO2 | PSO1 |
| CO3 | Apply concepts of surface chemistry in experimental procedures | K2 | PO2 | PSO2 |
| CO4 | Analyze and determining the surface tension of liquids through methods like drop count and drop weight techniques. | K2 | PO7 | PSO2 |
| CO5 | Evaluate the effect of surfactants (e.g., detergents) on surface tension using a stalagmometer. | K3 | PO1 | PSO2 |

**For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create**

| CO-PO MATRIX | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CO NO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | 2 | | | | | | | 1 | |
| CO2 | | 2 | | | | | | 1 | |
| CO3 | | 2 | | | | | | | 2 |
| CO4 | | | | | | | 2 | | 2 |
| CO5 | 2 | | | | | | | | 2 |

**Use the codes 3, 2, 1 for High, Moderate and Low correlation Between CO-PO-PSO respectively**

**Physical Chemistry Practical Syllabus:**

1. Determination of surface tension of liquid by drop count method
2. Determination of surface tension of liquid by drop weight method
3. Determination of surface tension of mixture (liquid + detergent) using stalagmometer.
4. Determination of coefficient of viscosity of an organic liquid.
5. Determination of composition of a glycerol in glycerol + water mixture usingviscometer.
6. Adsorption of acetic acid on animal charcoal, verification of Freundlich isotherm.
7. **Detrminiation of partition coefficient of iodine between carbon tetra chloride and water**

**Co-curricular activities and Assessment Methods:**

1) Continuous Evaluation: Monitoring the progress of student's learning

2) Class Tests, Worksheets 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 teachingmethods adopted by teachers throughout the SEMESTER.

**List of reference books:**

**1)** A Text Book of Quantitative Inorganic Analysis($3^{rd}$Edition) –A.I.Vogel

**2)** Web related references suggested by teacher.

Web Links:

1. https://www.sscollegejehanabad.org/study-material/333238879Properties%20of%20Liquid_B.Sc%20part%201%20chemistry%20(Hons.).pdf
2. https://davjalandhar.com/dbt/chemistry/SOP%20LabManuals/B.Sc.%20BT%20SEM%20III.pdf
3. https://royalsocietypublishing.org/doi/10.1098/rspa.1994.0039
4. https://daniellefiler.weebly.com/uploads/5/5/2/8/55282799/pchem_lab_4_aa.pdf

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**Title of the Paper: GENERAL AND PHYSICAL CHEMISTRY**

| **Course Code** | **23CHMAL242** | **Course Delivery Method** | **Class Room / Blended Mode** |
|---|---|---|---|
| Credits | **3** | CIA Marks | 30 |
| No. of Lecture Hours / Week | **3** | Semester End Exam Marks | **70** |
| Total Number of Lecture Hours | **60** | Total Marks | **100** |
| Year of Introduction : 2024-25 | Year of Offering: 2024-25 | Year of Revision: 2024-25 | Percentage of Revision: 100 |

**Semester: IV**

**Course Description:** This comprehensive course integrates several key areas of chemistry, including the three-dimensional structure of organic molecules, the role of metal ions in biological systems, the principles governing equilibria in ionic solutions, the kinetics of chemical reactions, and the mechanisms of enzyme catalysis. Students will develop a deep understanding of these important topics and their applications in fields such as biochemistry, pharmaceuticals, environmental chemistry, and industrial processes

**Course Objectives:**

| S.NO | COURSE OBJECTIVES |
|---|---|
| **1** | **Understanding Molecular Chirality**: To introduce the concepts of **chirality**, **optical activity**, and **enantiomers** in organic compounds, **Brønsted-Lowry** and **Lewis** theories of acids and bases, and calculate **pH**, **pKa**, and buffer capacities in solutions ,concept of **reaction rates**, **rate laws**, and **rate constants** for different types of reactions. |
| **2** | Explain **structural isomerism** (constitutional isomers) and **stereoisomerism** (geometrical and optical isomers), **coordination complexes** in biological molecules, such as **hemoglobin** and **myoglobin**, reaction mechanisms |
| **3** | To analyze difference between **diastereomers** and **enantiomers**, and the concept of **meso compounds** in chiral systems, how the addition of a common ion affects the solubility and equilibrium position of a salt in solution. |
| **4** | To understand the kinetics of **enzyme-substrate binding** and **transition states**. explore how stereochemistry affects the reactivity. |
| **5** | To interpret properties, and biological activity of carbon compounds in pharmaceuticals, materials science, and biochemistry. |

**Course outcomes:**

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

| CO NO | COURSE OUTCOME | BTL | PO | PSO |
|---|---|---|---|---|
| **CO1** | Remember and describe the stereo chemical properties of organic compounds | **K1** | **PO2** | **PSO1** |
| **CO2** | Understand the basic concepts of enzyme catalysis in rate determination | **K1** | **PO2** | **PSO1** |
| **CO3** | Apply the basic concepts to Determine the order of a chemical reaction | **K2** | **PO7** | **PSO2** |
| **CO4** | Analyze the biological significance of various elements present in the human body. | **K2** | **PO7** | **PSO2** |
| **CO5** | Evaluate the concepts of ionic equilibrium for the qualitative and quantitative analysis | **K3** | **PO7** | **PSO2** |

**For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create**

| CO-PO MATRIX | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **CO NO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PSO1** | **PSO2** |
| **CO1** | | **2** | | | | | | 1 | |
| **CO2** | | **2** | | | | | | 2 | |
| **CO3** | | | | | | | 2 | | 2 |
| **CO4** | | | | | | | **2** | | 2 |
| **CO5** | | | | | | | 2 | | 2 |

**Use the codes 3,2,1 for High, Moderate and Low correlation Between CO-PO-PSO respectively**

## Syllabus

**Course Details**

| Unit | Learning Units | Lecture Hours |
|---|---|---|
| | **GENERAL AND PHYSICAL CHEMISTRY** | |
| **I** | **UNIT-I Stereo chemistry of carbon compounds**<br>Molecular representations - Wedge, Fischer, Newman and Saw-Horse formulae.Optical isomerism: Optical activity- wave nature of light, plane polarised light, optical rotation and specific rotation. Chiral molecules-definition and criteria (Symmetry elements)- Definition of enantiomers and diastereomers – Explanation of optical isomerism with examples-Glyceraldehyde, Lactic acid, Alanine, Tartaric acid, 2,3-dibromopentane.<br>**D,L, R,S and E,Z- configuration with examples.**<br>**Definition of Racemic mixture – Resolution of racemic mixtures ( techniques)** | **9Hrs** |
| **II** | **Unit II Bioinorganic Chemistry**<br>Metal ions present in biological systems, classification of elements according to their action in biological system. Geochemical effect on the distribution of metals, Na / 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, Cisplatin as an anti-cancer drug. Iron and its application in bio-systems, Haemoglobin-transfer of oxygen, Myoglobin-Storage and transfer of iron | **9Hrs** |
| **III** | **Unit III Ionic equilibrium**<br>Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, Buffer solutions-Henderson's equation. Indicators-theories of acid – base Indicators, selection of Indicators,<br>Common ion effect Solubility and solubility product of sparingly soluble salts – applications of solubility product principle. | **9Hrs** |
| **IV** | **Unit IV Chemical Kinetics-I:**<br>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 (similar and different reactants). Half–life of a reaction. General methods for determination of order of a reaction | **9Hrs** |
| **V** | **Unit V Chemical Kinetics-II:** | **9Hrs** |

| | | |
|---|---|---|
| | 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).<br>Enzyme catalysis- Specificity, factors affecting enzyme catalysis, Inhibitors and Lock & key model. Michaels- Menten equation- derivation, significance of Michaelis-Menten constant. | |

**I. Reference books**


1) Text book of physical chemistry by S Glasstone

2) Concise Inorganic Chemistry by J.D.Lee

3) Advanced physical chemistry by Gurudeep Raj

4) Advanced physical chemistry by Bahl and Tuli

5) Inorganic Chemistry by J.E.Huheey

6) Basic Inorganic Chemistry by Cotton and Wilkinson.

1.https://www.uou.ac.in/lecturenotes/science/MSCCH-17/CHEMISTRY%20LN%201%20STERIOCHEMISTRY.pdf

2.https://www.deshbandhucollege.ac.in/pdf/resources/1585324665_BSc(H)-BSc-PS-LS-VI-Bioinorganic-2.pdf

3.https://nios.ac.in/media/documents/SrSec313NEW/313_Chemistry_Eng/313_Chemistry_Eng_Lesson12.pdf

4.https://vssut.ac.in/lecture_notes/lecture1425072667.pdf

5.https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Physical_Chemistry_(LibreTexts)/29%3A_Chemical_Kinetics_II-_Reaction_Mechanisms

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**Vuyyuru-521165**

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**Title of the Paper: GENERAL AND PHYSICAL CHEMISTRY**

**Semester: IV** **INTERNAL ASSESMENT QUESTION PAPER**

| | | |
|---|---|---|
| **SET No** | **1** | |
| **Course Code :**<br>**Title of the Course:** | **23CHMAL242**<br>**GENERAL AND PHYSICAL CHEMISTRY** | |
| **Offered to:** | **BSc Hons Chemistry** | |
| **Category:** | **SEMESTER** | **IV** |
| **Max.Marks for IA** | **30** | |
| **Max.Time** | **90 Min** | |

## Section A: Short Answer Questions (10 Marks)

**Answer all questions. Each question carries 5 Marks.**

Q1 (a) Define optical rotation and specific rotation. K1

OR

(b) Define Definition of enantiomers and diastereomer K2

Q2 (a) Explain Excess and deficiency of Hg, Pb and trace metals. K2

OR

(b) Describe Cisplatin as an anti-cancer drug. K2

## Section B: Long Answer Questions (20 Marks)

**Answer All questions. Each question carries 10 Marks.**

Q3 (a) Illustrate optical isomerism with following molecules Glyceraldehyde, Lactic acid, Alanine K3

OR

(b) Draw Wedge, Fischer, Newman and Saw-Horse representations formulae with an example each. K3

Q4 (a) Explain structure, Storage and transfer of oxygen of Haemoglobin K3

OR

(b) i) Classify elements according to their actionin biological system K3

ii) Iron and its application in bio-system

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**Title of the Paper: GENERAL AND PHYSICAL CHEMISTRY**

**Semester: IV**

**SEMESTER -END QUESTION PAPER**

| | |
|---|---|
| **Course Code & Title of the Course:** | **23CHMAL242 GENERAL AND PHYSICAL CHEMISTRY** |
| **Offered to:** | **BSc Hons Chemistry** |
| **Category:** | **SEMESTER: IV** |
| **Max. Marks** | **70** |
| **Max.Time** | **3 Hrs** |

**Section A: Short Answer Questions (20 Marks)**
**Answer all questions. Each question carries 4 Marks.**

**Answer all questions. Each question carries 4 Marks.**

Q1 (a) Discuss Optical activity with an example K1

OR

(b) Describe optical isomerism of Tartaric acid, 2,3-dibromopentane K1

Q2 (a) Explain Excess and deficiency of Hg, Pb and trace metals. K2

OR

(b) Describe Cisplatin as an anti-cancer drug. K2

Q3 (a) Interpret Henderson's equation K3

OR

(b) Illustrate ionization constant and ionic product of water K3

Q4 (a) Derive integrated rate equationsfor zero order reaction K4

OR

(b) Explain Effect of temperature on reaction rates K4

Q5 (a) Explain activation energy and its calculation from Arrhenius equation K4

OR

(b) Explain Inhibitors and Lock & key model. K4

## Section B: Long Answer Questions (50 Marks)

**Answer all questions. Each question carries 10 Marks.**

Q6 (a) Explan optical isomerism with following molecules Glyceraldehyde, Lactic acid, Alanine K2

OR

(b) Draw Wedge, Fischer, Newman and Saw-Horse representations formulae with an example each. K2

Q7 (a) Explain structure, Storage and transfer of oxygen of Haemoglobin K2

OR

(b) i) Classify elements according to their actionin biological system K2

ii) Iron and its application in bio-systems

Q8 (a) Interpret theories of acid – base Indicators K3

OR

(b) Give note on Common ion effect Solubility and solubility product of sparingly soluble salts and its applications K3

Q9 (a) Derive integrated rate equations for first and second order reaction K4

OR

(b) Explain methods for determination of order of a reaction K4

Q10 (a) Explain Collision theory and Activated Complex theory. K4

OR

(b) Derive Michaels- Menten equation its significance K4

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**Title of the Paper: Physical Chemistry - Volumetric Analysis**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | | | | **23CHMAP242** | | | |
| **Title of the Course** | | | | **Physical Chemistry - Volumetric Analysis** | | | |
| **Offered to: (Programme/s)** | | | | B.Sc. Hons Chemistry | | | |
| **L** | **0** | **T** | **0** | **P** | **2** | **C** | **1** |
| **Year of Introduction:** | **2024-25** | | | **Semester:** | | | **IV** |
| **Course Category:** | **MAJOR** | | | **Course Relates to:** | **GLOBAL** | | |
| **Year of Revision:** | **2024** | | | **Percentage:** | **NA** | | |
| **Type of the Course:** | | | | Employability | | | |
| **Crosscutting Issues of the Course :** | | | | Environment and Sustainability | | | |
| **Pre-requisites, if any** | | | | Basic knowledge on volumetric analysis | | | |

**Semester: IV**

**Course Description:**

This course provides an introduction to the principles and techniques of volumetric analysis, focusing on titration methods for determining substance concentrations. Topics include solution preparation, standardization, indicator selection, endpoint detection, and practical applications in environmental, industrial, and pharmaceutical analysis. Emphasis is placed on precision, accuracy, and analytical skills. Suitable for students in chemistry and related fields.

**Course Objectives:**

| S.NO | COURSE OBJECTIVES |
|---|---|
| 1 | Recall the basic principles of volumetric analysis and the types of titrations (e.g., acid-base, redox).List common indicators and their purposes in detecting endpoints. |
| 2 | Explain the processes of preparing and standardizing solutions. Describe the significance of stoichiometric relationships in volumetric analysis. |
| 3 | Perform accurate titrations using laboratory glassware and record observations.Apply volumetric methods to determine the concentration of unknown solutions. |
| 4 | Differentiate between various types of titrations based on their chemical principles. Analyze the factors affecting endpoint detection and titration accuracy. |
| 5 | Design a volumetric analysis experiment to address a specific analytical problem.Develop innovative approaches to improve the efficiency and reliability of titration techniques. |

**Course outcomes:**

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

| CO NO | COURSE OUTCOME | BTL | PO | PSO |
|---|---|---|---|---|
| CO1 | Use glassware, equipment and chemicals and follow experimental procedures in the laboratory | K1 | PO2 | PSO1 |
| CO2 | Understand and explain the volumetric analysis based on fundamental concepts learnt in ionic equilibria | K1 | PO2 | PSO1 |
| CO3 | Apply concepts of a standard solutions, primary and secondary standards in volumetric analysis | K2 | PO1 | PSO1 |
| CO4 | Facilitate the learner to make solutions of various molar concentrations for analyze and estimate the unknown sample | K2 | PO7 | PSO2 |
| CO5 | Evaluate volumetric analysis based on fundamental concepts to determine unknown sample . | K3 | PO1 | PSO2 |

**For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create**

| CO-PO MATRIX | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CO NO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | 1 | | | | | | 1 | |
| CO2 | | 2 | | | | | | 2 | |
| CO3 | 2 | | | | | | | 2 | |
| CO4 | | | | | | | 2 | | 2 |
| CO5 | 2 | | | | | | | | 3 |

**Use the codes 3,2,1 for High, Moderate and Low correlation Between CO-PO-PSO respectively**

## Syllabus

**Volumetric analysis:**

1. Estimation of sodium hydroxide using standardised HCl solution.
2. Estimation of sodium carbonate and sodium hydroxide present in a mixture.
3. Determination of Fe (II) using KMnO4 with oxalic acid as primary standard. (internal indicator method)
4. Determination of Fe (II) using KmnO4 with oxalic acid as primary standard. (external indicator method)
5. Estimation of of Mg+2 by EDTA (complexometric titration)
6. Determination of first order rate constant by hydrolysis of Ester

III. **Co-curricular activities and assessment methods:**

**1.** Continuous Evaluation: Monitoring the progress of student's learning

**2.** Class Tests, Worksheets 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 andteaching methods adopted by teachers throughout the SEMESTER .

**II. List of reference books:**

**1.** A Text Book of Quantitative Inorganic Analysis(3rd Edition) –A.I.Vogel

**2.** Web related references suggested by teacher.

Web Links:

1.https://www.bdu.ac.in/cde/SLM/B.Sc.%20Chemistry/I%20Year/Major%20Paper%20II%20Practical%20-%20I%20Volumetric%20Analysis.indd.pdf

2. https://allbachelor.com/2021/01/27/1-to-estimate-the-amount-of-naoh-and-na2co3-in-the-given-mixture-of-naoh-and-na2co3/

3. https://www.nsec.ac.in/images/bes_REDOX%20TITRATION.pdf

4. https://kahedu.edu.in/naac/C-3/Additional%20documents/E-content/426.pdf

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**Title of the Paper: Nitrogen containing Organic Compounds & Spectroscopy**

| **Course Code** | **23CHMAL243** | **Course Delivery Method** | **Class Room / Blended Mode** |
|---|---|---|---|
| Credits | **3** | CIA Marks | 30 |
| No. of Lecture Hours / Week | **3** | Semester End Exam Marks | **70** |
| Total Number of Lecture Hours | **60** | Total Marks | **100** |
| Year of Introduction : 2024-25 | Year of Offering: 2024-25 | Year of Revision: 2024-25 | Percentage of Revision: 100 |

**Semester: IV**

**Course Description:** This course provides an in-depth study of **nitrogen-containing organic compounds** and the various **spectroscopic techniques** used to analyze organic molecules. Students will explore the synthesis, reactivity, and applications of nitrogen-containing compounds in organic chemistry, along with a detailed understanding of **spectroscopic methods** used for structure elucidation and analysis. The course aims to develop practical and theoretical skills in analyzing organic molecules and their behavior through spectroscopy.

**Course Aims and Objectives:**

| **S.NO** | **COURSE OBJECTIVES** |
|---|---|
| **1** | Learn about the different classes of nitrogen-containing compounds, including amines, amides, nitriles, azides, and heterocycles.<br>Learn how to interpret and apply common spectroscopic techniques (e.g., **IR, UV**) for the identification and analysis of nitrogen-containing organic compounds. |
| **2** | Recognize the structural and electronic properties of nitrogen atoms in organic compounds.<br>Study the reactivity, synthesis, and functionalization of nitrogen-containing organic molecules. |
| **3** | Understand the key reaction mechanisms specific to nitrogen-containing organic compounds.<br>Study electrophilic aromatic substitution and its variations in nitrogen-containing heterocycles. |
| **4** | Analyze the role of nitrogen in nucleophilic substitution, elimination reactions, and other key organic transformations. |
| **5** | Gain proficiency in distinguishing functional groups based on their spectral data.<br>Encourage the application of theoretical knowledge to practical problems, including synthesis and structure elucidation. |

**Course outcomes:**

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

| CO NO | OURSE OUTCOME | BTL | PO | PSO |
|---|---|---|---|---|
| **CO1** | Remember and distinguish primary secondary and tertiary amines and their properties. | **K1** | **PO2** | **PSO1** |
| **CO2** | Understand the methods of preparation and properties of amino acids. | **K1** | **PO2** | **PSO1** |
| **CO3** | Apply the reactivity of nitro hydrocarbons including mechanisms such as Nef reaction and Mannich reaction leading to Micheal addition and reductions. | **K3** | **PO2** | **PSO1** |
| **CO4** | Analyse properties and applications of Heterocyclic compounds with N, O and S containing 5-membered ring. | **K2** | **PO7** | **PSO2** |
| **CO5** | Evaluate the concepts of UV and IR to ascertain the functional group in an organiccompound | **K3** | **PO6** | **PSO2** |

**For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create**

| CO-PO MATRIX | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **CO NO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PSO1** | **PSO2** |
| **CO1** | | **1** | | | | | | 2 | |
| **CO2** | | **2** | | | | | | 2 | |
| **CO3** | | **2** | | | | | | **2** | |
| **CO4** | | | | | | | **2** | | 2 |
| **CO5** | | | | | | 2 | | | 3 |

**Use the codes 3,2,1 for High, Moderate and Low correlation Between CO-PO-PSO respectively**

## Syllabus

**Course Details**

| Unit | Learning Units | Lecture Hours |
|---|---|---|
| | **Nitrogen containing Organic Compounds & Spectroscopy** | |
| **I** | **Unit I Amines:**<br>Classification, chirality in amines (pyramidal inversion), **Basicity of amines: Effect of substituent, solvent and steric effects**. preparations – Gabriel synthesis,Hoffmann- Bromamide reaction (with mechanism), reduction of amides and Schmidt reaction. Distinction between Primary, secondary and tertiary amines using Hinsberg's method and nitrous acid. Discussion of the following reactions with emphasis on the mechanistic pathway: Carbylamine reaction, Hoffmann's exhaustive methylation, Hofmann and Cope elimination.<br>Diazonium Salts: Preparation and synthetic applications of diazonium salts including preparation of arenes, haloarenes, phenols, cyano and nitro compounds. Coupling reactions ofdiazonium salts (preparation of azo dyes) | **9Hrs** |
| **II** | **UNIT- II Amino acids**<br>Definition and 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: **specific examples - Glycine, Alanine, valine and leucine** a) from halogenated carboxylic acid, b) Gabriel Phthalimide synthesis c) Strecker's synthesis.<br>Physical properties: Zwitter ion structure - salt like character - solubility, melting points, amphoteric character, definition of isoelectric point. 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. | **9Hrs** |
| **III** | **UNIT- III Nitro hydrocarbons**<br>Nomenclature and classification, structure -Tautomerism of nitroalkanes leading to acid and keto form, Preparation of Nitroalkanes, reactivity - halogenation, reaction with HONO (Nitrous acid), Nef reaction and Mannich reaction leading to Micheal addition and reduction. | **9Hrs** |
| **IV** | | **9Hrs** |

| | | |
|---|---|---|
| | **Unit IV Heterocyclic Compounds**<br>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 - electrophillic substitution at 2 or 5 position, Halogenation, Nitration and Sulphonation - Diels Alder reaction in furan. Pyridine – synthesis - Aromaticity -Basicity - Comparison with pyrrole- one method of preparation and properties - Reactivity towards Nucleophilic substitution reaction. | |
| **V** | **UnitV UV-Visible & IR Spectroscopy**<br>Selection rules for electronic spectra, types of electronic transitions in molecules, concept of chromophore and auxochrome, effect of conjugation- Woodward Fischer rules for calculating<br>$\lambda_{max}$ of conjugated dienes and $\alpha,\beta$ unsaturated compounds. Infrared spectroscopy and types of molecular vibrations and fingerprint region. IR spectra of alkanes, alkenes and simple alcohols (inter and intra molecular hydrogen bonding), aldehydes, ketones, carboxylic acids. | **9Hrs** |

**I. List of Reference Books**


1) A Text Book of Organic Chemistry by Bahl and Arunbahl
2) A Text Book of Organic chemistry by I L FinarVol I
3) Organic chemistry by Bruice
4) Organic chemistry by Clayden
5) Spectroscopy by William Kemp
6) Spectroscopy by Pavia
7) Organic Spectroscopy by J. R. Dyer
8) Elementary organic spectroscopy by Y.R. Sharma
9) Spectroscopy by P.S.Kalsi
10) Spectrometric Identification of Organic Compounds by Robert MSilverstein, Francis X


Web Links:

1. https://www.britannica.com/science/amine/Occurrence-and-sources-of-amines
2. https://www.britannica.com/science/amino-acid
3. https://www.lkouniv.ac.in/site/writereaddata/siteContent/202003291608409347arun_sethi_Nitro_compounds.pdf
4. https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/heterocy.htm
5. https://www.eag.com/techniques/spectroscopy/uv-vis-spectroscopy/

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**Title of the Paper: Nitrogen containing Organic Compounds & Spectroscopy**

**Semester: INTERNAL ASSESMENT QUESTION PAPER**

| | | |
|---|---|---|
| **SET No** | **1** | |
| **Course Code :**<br>**Title of the Course:** | **23CHMAL243**<br>**Nitrogen containing Organic Compounds & Spectroscopy** | |
| **Offered to:** | **BSc Hons Chemistry** | |
| **Category:** | **SEMESTER** | **3** |
| **Max.Marks for IA** | **30** | |
| **Max.Time** | **90 Min** | |

**Section A: Short Answer Questions (10 Marks)**

**Answer all questions. Each question carries 5 Marks.**

Q1 (a) Describe Hinsberg's method **for** distinction of amines K1

OR

(b) Discuss Hofmann and Cope elimination. K1

Q2 (a) Explain isoelectric point and Zwitter ion structure of amino acids K2

OR

(b) Describe Structure and nomenclature of proteins. K2

**Section B: Long Answer Questions (20 Marks)**

**Answer All questions. Each question carries 10 Marks.**

Q3 (a) Describe any three methods for preparations of amines K2

OR

(b) Discuss preparation diazonium salts from haloarenes, phenols, and nitro compounds. K2

Q4 (a) Use Gabriel Phthalimide synthesis and Strecker's synthesis for preparation of amino acids K3

OR

(b) Interpret classification of Amino acids and write formation of lactams from gamma and delta amino acids. K3

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**Title of the Paper: Nitrogen containing Organic Compounds & Spectroscopy**

**Semester: IV**

**SEMESTER -END QUESTION PAPER**

| | |
|---|---|
| **Course Code & Title of the Course:** | **23CHMAL243**<br>**Nitrogen containing Organic Compounds & Spectroscopy** |
| **Offered to:** | **BSc Hons Chemistry** |
| **Category:** | **SEMESTER: III** |
| **Max. Marks** | **70** |
| **Max.Time** | **3 Hrs** |

## Section A: Short Answer Questions (20 Marks)

**Answer all questions. Each question carries 4 Marks.**

Q1 (a) Discuss Hofmann and Cope elimination.. K1

OR

(b) Describe Hinsberg's method **for** distinction of amines K1

Q2 (a) Explain isoelectric point and Zwitter ion structure of amino acids K2

OR

(b) Describe Structure and nomenclature of proteins K2

Q3 (a) Show structure and Tautomerism of nitroalkanes K3

OR

(b) Interpret Micheal addition reaction . K3

Q4 (a) Explain aromatic nature of Furan and Pyridine K4

OR

(b) Explain Acidic character of pyrrole K4

Q5 (a) Explain chromophore and auxochrome with an example each K3

OR

(b) Contrast fingerprint region and fundamental region K3

## Section B: Long Answer Questions (50 Marks)

**Answer all questions. Each question carries 10 Marks.**

Q6 (a) Describe any three methods for preparations of amines K1

OR

(b) Discuss Discuss preparation diazonium salts from haloarenes, phenols, and nitro compounds. K1

Q7 (a) Describe Gabriel Phthalimide synthesis and Strecker's synthesis for preparation of amino acids K2

OR

(b) Classify Amino acids and write formation of lactams from gamma and delta amino acids K2

Q8 (a) Prepare Nitroalkanes and gives its reactions with Halogen and Nitrous acid K3

OR

(b) Interpret Nef reaction and Mannich reaction point K3

Q9 (a) Explain any three methods of synthesis and reactions of pyridine K4

OR

(b) Explain any three methods of synthesis and reactions of Pyrrole K4

Q10 (a) Order Woodward Fischer rules for calculating $\lambda_{max}$ of conjugated dienes and $\alpha,\beta$ unsaturated carbonyl compounds K4

OR

(b) Order types of molecular vibrations in IR K4

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| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | | | | **23CHMAP243** | | | |
| **Title of the Course** | | | | **Organic preparations and IR Spectral Analysis** | | | |
| **Offered to: (Programme/s)** | | | | B.Sc. Hons Chemistry | | | |
| **L** | | **T** | **0** | **P** | **2** | **C** | **1** |
| **Year of Introduction:** | **2024-25** | | | **Semester:** | | | **IV** |
| **Course Category:** | **MAJOR** | | | **Course Relates to:** | **GLOBAL** | | |
| **Year of Revision:** | **2024** | | | **Percentage:** | **NA** | | |
| **Type of the Course:** | | | | Employability | | | |
| **Crosscutting Issues of the Course :** | | | | Environment and Sustainability | | | |
| **Pre-requisites, if any** | | | | 23CHMAP232 | | | |

**Title of the Paper: Organic preparations and IR Spectral Analysis**

**Semester: IV**

**Course Description:** The course is designed to provide practical skills in laboratory preparation of organic compounds as well as the theoretical and practical understanding of how IR spectroscopy can be used to determine the structure and identity of organic molecules This course introduces students to the fundamental techniques in organic synthesis and the analysis of organic compounds using Infrared (IR) Spectroscopy.

| S.NO | COURSE OBJECTIVES |
|---|---|
| **1** | **Understanding** organic reactions, including nucleophilic substitution, electrophilic addition, elimination, and rearrangement reactions, to synthesize a variety of organic compounds.. |
| **2** | Grasp the basic principles of infrared spectroscopy, including the interaction of infrared radiation with molecules and the concept of vibrational energy levels. |
| **3** | Learn how different functional groups in organic molecules absorb infrared light at characteristic wavelengths and how these absorptions relate to molecular structure. |
| **4** | Synthesize organic compounds in the laboratory, and then use IR spectroscopy to confirm the identity and purity of the products. |
| **5** | Develop skills in accurately interpreting experimental data and spectral results, Develop skills in accurately interpreting experimental data and spectral results. |

**Course outcomes:**

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

| CO NO | COURSE OUTCOME | BTL | PO | PSO |
|---|---|---|---|---|
| CO1 | Use glassware, equipment and chemicals and follow experimental procedures in thelaboratory | K1 | PO1 | PSO1 |
| CO2 | Understand concepts and Calculate limiting reagent, theoretical yield, and percent yield. | K1 | PO2 | PSO1 |
| CO3 | Engage in safe laboratory practices by handling laboratory glassware, equipment, andchemical reagents appropriately | K2 | PO2 | PSO1 |
| CO4 | Dispose of chemicals in a safe and responsible manner | K2 | PO6 | PSO2 |
| CO5 | Perform common laboratory techniques including reflux, distillation, recrystallization,vacuum filtration | K3 | PO6 | PSO2 |

**For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create**

| CO-PO MATRIX | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CO NO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | 1 | | | | | | | 1 | |
| CO2 | | 2 | | | | | | 2 | |
| CO3 | | 2 | | | | | | 2 | |
| CO4 | | | | | | 2 | | | 3 |
| CO5 | | | | | | 3 | | | 2 |

**Use the codes 3,2,1 for High, Moderate and Low correlation Between CO-PO-PSO respectively**

## Syllabus

**A. Organic preparations: 40M**

1) Acetylation of one of the following compounds: amines (aniline, o-, m-, ptoluidinesand o-, m-, p-anisidine)

a. Using conventional method.

b. Using green approach

2) Benzoylation of one of the following amines (aniline, o-, m-, p- toluidines and o-, m-,p-anisidine)

3) Nitration of any one of the following: Acetanilide/nitrobenzene by conventional method

**B. IR Spectral Analysis 10M**

IR Spectral Analysis of the following functional groups with examples a) Hydroxyl groups b) Carbonyl groups c) Amino groups d) Aromatic groups

**Co-curricular activities and assessment methods:**

1. Continuous Evaluation: Monitoring the progress of student's learning
2. Class Tests, Worksheets 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 andteaching methods adopted by teachers throughout the SEMESTER.

**List of reference books:**


1. Vogel A.I .Practical Organic Chemistry, Longman Group Ltd.
2. Bansal R.K. Laboratory Manual of Organic Chemistry, Wiley-Eastern.
3. Ahluwalia V. K. and Agarwal R. Comprehensive Practical Organic Chemistry,University press.


Web related references suggested by teacher.

1.https://chem.libretexts.org/Ancillary_Materials/Laboratory_Experiments/Wet_Lab_Experiments/Organic_Chemistry_Labs/The_Synthesis_and_Characterization_of_Carbonyl_Compounds/1%3A_Acetylation_of_Aniline_(Experiment)

2. https://dnrcollege.org/2024/eContent/CHE/3M.pdf

3 https://egyankosh.ac.in/bitstream/123456789/13205/1/Experiment-11.pdf

4. https://ncert.nic.in/pdf/publication/sciencelaboratorymanuals/classXII/chemistry/lelm110.pdf

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**Title of the Paper: Physical chemistry–II (States of Matter, Phase rule &Surface Chemistry)**

**Semester: IV**

| **Course Code** | **23CHMIL241** | **Course Delivery Method** | **Class Room / Blended Mode** |
|---|---|---|---|
| Credits | **3** | CIA Marks | 30 |
| No. of Lecture Hours / Week | **3** | Semester End Exam Marks | **70** |
| Total Number of Lecture Hours | **60** | Total Marks | **100** |
| Year of Introduction : 2024-25 | Year of Offering: 2024-25 | Year of Revision: 2024-25 | Percentage of Revision: 100 |

**COURSE DESCRIPTION:**
Physical Chemistry II, focusing on the **States of Matter**, **Phase Rule**, and **Surface Chemistry**, provides a deeper understanding of the behavior of matter at the molecular and macroscopic levels. Building on the fundamental principles of thermodynamics and kinetics, this course explores the physical characteristics and transitions of matter, the application of the Phase Rule to complex systems, and the unique properties of surfaces in various chemical processes

**Course Aims and Ob**

| S.NO | COURSE OBJECTIVES |
|---|---|
| **1** | To explore and comprehend the basic principles governing the three main states of matter (solid, liquid, and gas), To introduce the **Phase Rule** and its application to single and multi-component systems in equilibrium |
| **2** | To study the properties of matter in different states, including the concept of intermolecular forces and the behavior of gases, liquids, and solids, To understand the concept of **degrees of freedom**, **phase diagrams**, and **coexistence of phases** in various systems. |
| **3** | To analyze the relationship between temperature, pressure, and volume in the context of gas laws (Ideal Gas Law, Van der Waals equation, etc.) To study the phase transitions (e.g., fusion, vaporization, sublimation) and the relationship between the phases (solid, liquid, gas) in different thermodynamic systems. |
| **4** | To gain insights into the behavior of real gases and the factors affecting their deviation from ideal gas behavior, To apply the Phase Rule to complex systems such as binary mixtures, colligative properties, and critical phenomena. |
| **5** | To interpret phase diagrams and calculate the number of independent variables for different types of systems. To examine the structure and properties of surfaces, including **adsorption** and **desorption** phenomena, and the factors affecting these processes. |

**Course outcomes:**

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

| CO NO | COURSE OUTCOME | BTL | PO | PSO |
|---|---|---|---|---|
| CO1 | Remember and Explain the difference between solids liquids and gases in terms of intermolecularinteractions. | K1 | PO2 | PSO1 |
| CO2 | Understand and apply surface chemistry principles to practical scenarios, such as catalysis, adsorption, and colloid stability. | K1 | PO2 | PSO1 |
| CO3 | Apply basic concepts of two component systems | K2 | PO2 | PSO1 |
| CO4 | Analyze phase diagrams and calculate degrees of freedom. | K2 | PO7 | PSO2 |
| CO5 | Evaluate the concepts of adsorption and Apply the Phase Rule to understand the equilibria in multi-component systems. | K3 | PO1 | PSO2 |

**For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create**

| CO-PO MATRIX | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CO NO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | 1 | | | | | | 2 | |
| CO2 | | 1 | | | | | | 2 | |
| CO3 | | 2 | | | | | | 2 | |
| CO4 | | | | | | | 2 | | 2 |
| CO5 | 2 | | | | | | | | 2 |

**Use the codes 3,2,1 for high, moderate and low correlation between co-po-pso respectively**

## Syllabus

**Course Details**

| Unit | Learning Units | Lecture Hours |
|---|---|---|
| **Physical chemistry –II (States of Matter, Phase rule &Surface Chemistry)** | | |
| **I** | **Unit I - Gaseous state**<br>Postulates of Kinetic theory of Gases (exclude derivation) – deduction of gas laws from kinetic gas equation-Vander Waal's equation of state. Andrew's isotherms of carbon dioxide, continuity of state. Critical phenomena. Relationship between critical constants and vander Waal's constants. Law of corresponding states. Joule- Thomson effect. Inversion temperature. | **9Hrs** |
| **II** | **Unit II – Liquid State**<br>Physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity, and their determination. Effect of addition of various solutes on surface tension and viscosity. Temperature variation of viscosity of liquids and comparison with that of gases. Qualitative discussion of structure of water.<br>Liquid crystals, mesomorphic state. Differences between liquid crystal and solid/liquid. Classification of liquid crystals into Smectic and Nematic. Application of liquid crystals as LCD devices | **9Hrs** |
| **III** | **UNIT-III - Solid state**<br>Symmetry in crystals. Law of constancy of interfacial angles. The law of rationality of indices. Miller indices, Definition of lattice point, space lattice, unit cell. Bravais lattices and crystal systems. X-ray diffraction and crystal structure. Bragg's law and its derivation. Powder method. Defects in crystals. Stoichiometric and non-stoichiometric defects. | **9Hrs** |
| **IV** | **Unit IV - Phase Rule**<br>The Concept of phase, components, degrees of freedom. Gibbs phase rule. Phase diagram of one component system – water system, Study of Phase diagrams of Simple eutectic systems<br>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 | **9Hrs** |
| **V** | **Unit V Surface Chemistry**<br>Definition and classification of Colloids- Coagulation of colloids- Hardy-Schulze rule.Stability of colloids, Protection of Colloids, Gold number.<br>Adsorption -Physical and chemical adsorption, Freundlich and Langmuir adsorptionisotherm, applications of adsorption. | **9Hrs** |

## II. List of Reference Books:

1.Solid State Chemistry and its applications by Anthony R. West

2.Text book of physical chemistry by K L Kapoor Vol.1
3.Text book of physical chemistry by S Glasstone

4.Advanced physical chemistry by Bahl and Tul

Web links :

https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/DeVoes_Thermodynamics_and_Chemistry/02%3A_Systems_and_Their_Properties/2.02%3A_Phases_and_Physical_States_of_Matter

http://www.gcekjr.ac.in/pdf/lectures/2020/6606-_2nd%20Semester_ALL.pdf

https://www.studiestoday.com/worksheets/447/chemistry.html

https://www.mlsu.ac.in/econtents/1210_surfacechemistrytutornotes-190628091806.pdf

https://www.nios.ac.in/media/documents/SrSec313NEW/313_Chemistry_Eng/313_Chemistry_Eng_Lesson6.pd

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**Title of the Paper: Physical chemistry –II (States of Matter, Phase rule &Surface Chemistry)**

**Semester: IV**

**INTERNAL ASSESMENT QUESTION PAPER**

| | | |
|---|---|---|
| **SET No** | **1** | |
| **Course Code :**<br>**Title of the Course:** | **23CHMIL241**<br>**PHYSICAL CHEMISTRY – II**<br>(States of Matter, Phase Rule & Surface Chemistry | |
| **Offered to:** | **BSc Hons Chemistry** | |
| **Category:** | **SEMESTER** | **3** |
| **Max.Marks for IA** | **30** | |
| **Max.Time** | **90 Min** | |

**Section A: Short Answer Questions (10 Marks)**

**Answer all questions. Each question carries 5 Marks.**

Q1 (a) Describe Joule- Thomson effect. K1

OR

(b) Discuss Vander Waal's equation of state.. K1

Q2 (a) Explain Differences between liquid crystal and solid/liquid. K2

OR

(b) Describe Physical properties of liquids. K2

**Section B: Long Answer Questions (20 Marks)**

**Answer All questions. Each question carries 10 Marks.**

Q3 (a) Illustrate Andrew's isotherms of carbon dioxide K3

OR

(b) Give Relationship between critical constants and vander Waal's constants. K3

Q4 (a) Classify liquid crystals. And give its applications K3

OR

(b) Explain Effect of addition of various solutes on surface tension and viscosity K3

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**Title of the Paper: Physical chemistry –II (States of Matter, Phase rule &Surface Chemistry)**

**Semester: IV**

**SEMESTER -END QUESTION PAPER**

| | |
|---|---|
| **Course Code & Title of the Course:** | **23CHMIL241**<br>**PHYSICAL CHEMISTRY –II**<br>States of Matter, Phase Rule & Surface Chemistry |
| **Offered to:** | **BSc Hons Chemistry** |
| **Category:** | **SEMESTER: III** |
| **Max. Marks** | **70** |
| **Max.Time** | **3 Hrs** |

**Section A: Short Answer Questions (20 Marks)**
**Answer all questions. Each question carries 4 Marks.**

| | | |
|---|---|---|
| Q1 | (a) Discuss Vander Waal's equation of state. | K1 |
| | OR | |
| | (b) Describe Joule- Thomson effect. | K1 |
| Q2 | (a) Explain Differences between liquid crystal and solid/liquid | K1 |
| | OR | |
| | (b) Describe Physical properties of liquids. | K1 |
| Q3 | (a) Describe Law of constancy of interfacial angles | K2 |
| | OR | |
| | (b) Explain Stoichiometric and non-stoichiometric defects | K2 |
| Q4 | (a) Explain phase, components, degrees of freedom. | K2 |
| | OR | |
| | (b) Explain the Gibbs phase rule | K2 |
| Q5 | (a) Illustrate Physical and chemical adsorption | K3 |
| | OR | |
| | (b) Give the definition and classification of Colloids | K3 |

**Section B: Long Answer Questions (50 Marks)**

**Answer all questions. Each question carries 10 Marks.**

**Answer all questions. Each question carries 10 Marks.**

Q6 (a) Describe Andrew's isotherms of carbon dioxide K1

OR

(b) Discuss Relationship between critical constants and vander Waal's constants. K1

Q7 (a) Classify liquid crystals. And give its applications

OR

(b) Explain Effect of addition of various solutes on surface tension and viscosity K2

Q8 (a) Interpret X-ray diffraction and crystal structure. Bragg's law and its derivation K3

OR

(b) Give note on law of rationality of indices. Miller indices, Definition of lattice point K3

Q9 (a) Draw and discuss Phase diagrams of Pb-Ag system, desilverisation of lead K3

OR

(b) Draw and discuss Phase diagrams of NaCl-Water system, K3

Q10 (a) Interpret Coagulation of colloids- Hardy-Schulze rule and Gold number. K3

OR

(b) Explain Freundlich and Langmuir adsorptionisotherm K3

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**Title of the Paper: Physical chemistry –II (States of Matter, Phase rule &Surface Chemistry)**

**Semester: IV**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | | | | **23CHMIP241** | | | |
| **Title of the Course** | | | | **PHYSICAL CHEMISTRY –II** | | | |
| **Offered to: (Programme/s)** | | | | B.Sc. Hons Chemistry | | | |
| **L** | **0** | **T** | **0** | **P** | **2** | **C** | **1** |
| **Year of Introduction:** | **2024-25** | | | **Semester:** | | | **IV** |
| **Course Category:** | **Minor** | | | **Course Relates to:** | **GLOBAL** | | |
| **Year of Revision:** | **2024** | | | **Percentage:** | **NA** | | |
| **Type of the Course:** | | | | Employability,skill | | | |
| **Crosscutting Issues of the Course :** | | | | Environment and Sustainability | | | |
| **Pre-requisites, if any** | | | | | | | |

**COURSE DESCRIPTIONS:**

This course provides an in-depth understanding of the fundamental principles of physical chemistry, with a focus on surface tension, viscosity, and adsorption. Through hands-on laboratory experiments, students will learn to measure and analyze physical properties of liquids and mixtures using modern experimental techniques. The course emphasizes the practical application of theoretical concepts, offering insights into the interplay of molecular interactions, surface phenomena, and bulk properties in real-world systems.

**Course Aims and Objectives:**

| S.NO | COURSE OBJECTIVES |
|---|---|
| **1** | To familiarize students with experimental techniques for determining surface tension using drop count and drop weight methods. |
| **2** | To understand the principles of fluid viscosity and its role in various chemical and physical systems. |
| **3** | To apply theoretical principles with practical applications in industries such as detergents, pharmaceuticals, and materials science.. |
| **4** | To foster critical thinking by analyzing experimental outcomes and comparing them with theoretical expectations. |
| **5** | To gain a comprehensive understanding of surface and interfacial phenomena, fluid dynamics, and adsorption, as well as the skills to apply these concepts effectively in scientific and industrial contexts. |

**Course outcomes:**

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

| CO NO | COURSE OUTCOME | BTL | PO | PSO |
|---|---|---|---|---|
| CO1 | Use glassware, equipment and chemicals and follow experimental procedures in thelaboratory | K1 | PO1 | PSO1 |
| CO2 | Understand and familiar with the concepts & practical applications of Surface tension and viscosityof liquids | K1 | PO2 | PSO1 |
| CO3 | Apply concepts of surface chemistry in experimental procedures | K2 | PO2 | PSO2 |
| CO4 | Analyze and determining the surface tension of liquids through methods like drop count and drop weight techniques. | K2 | PO7 | PSO2 |
| CO5 | Evaluate the effect of surfactants (e.g., detergents) on surface tension using a stalagmometer. | K3 | PO1 | PSO2 |

**For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create**

| CO-PO MATRIX | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CO NO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | 2 | | | | | | | 1 | |
| CO2 | | 2 | | | | | | 1 | |
| CO3 | | 2 | | | | | | | 2 |
| CO4 | | | | | | | 2 | | 2 |
| CO5 | 2 | | | | | | | | 2 |

**Use the codes 3, 2, 1 for High, Moderate and Low correlation Between CO-PO-PSO respectively**

## Physical Chemistry Practical Syllabus:

1.Determination of surface tension of liquid by drop count method

2.Determination of surface tension of liquid by drop weight method

3.Determination of surface tension of mixture (liquid + detergent) using stalagmometer.

4.Determination of coefficient of viscosity of an organic liquid.

5. Determination of composition of a glycerol in glycerol + water mixture usingviscometer.

6. Adsorption of acetic acid on animal charcoal, verification of Freundlich isotherm.

**7. Detrminiation of partition coefficient of iodine between carbon tetra chloride and water**

**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 teachingmethods adopted by teachers throughout the SEMESTER.

**List of reference books:**

- A Text Book of Quantitative Inorganic Analysis(3rd Edition) –A.I.Vogel
- Web related references suggested by teacher.

Web Links:

1. https://www.sscollegejehanabad.org/study-material/333238879Properties%20of%20Liquid_B.Sc%20part%201%20chemistry%20(Hons.).pdf
2. https://davjalandhar.com/dbt/chemistry/SOP%20LabManuals/B.Sc.%20BT%20SEM%20III.pdf
3. https://royalsocietypublishing.org/doi/10.1098/rspa.1994.0039
4. https://daniellefiler.weebly.com/uploads/5/5/2/8/55282799/pchem_lab_4_aa.pdf

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**Title of the Paper: GENERAL AND PHYSICAL CHEMISTRY**

| **Course Code** | **23CHMIL242** | **Course Delivery Method** | **Class Room / Blended Mode** |
|---|---|---|---|
| Credits | **3** | CIA Marks | 30 |
| No. of Lecture Hours / Week | **3** | Semester End Exam Marks | **70** |
| Total Number of Lecture Hours | **60** | Total Marks | **100** |
| Year of Introduction : 2024-25 | Year of Offering: 2024-25 | Year of Revision: 2024-25 | Percentage of Revision: 100 |

**Semester: IV**

**Course Description:** This comprehensive course integrates several key areas of chemistry, including the three-dimensional structure of organic molecules, the role of metal ions in biological systems, the principles governing equilibria in ionic solutions, the kinetics of chemical reactions, and the mechanisms of enzyme catalysis. Students will develop a deep understanding of these important topics and their applications in fields such as biochemistry, pharmaceuticals, environmental chemistry, and industrial processes

**Course Objectives:**

| S.NO | COURSE OBJECTIVES |
|---|---|
| **1** | **Understanding Molecular Chirality**: To introduce the concepts of **chirality**, **optical activity**, and **enantiomers** in organic compounds, **Brønsted-Lowry** and **Lewis** theories of acids and bases, and calculate **pH**, **pKa**, and buffer capacities in solutions ,concept of **reaction rates**, **rate laws**, and **rate constants** for different types of reactions. |
| **2** | Explain **structural isomerism** (constitutional isomers) and **stereoisomerism** (geometrical and optical isomers), **coordination complexes** in biological molecules, such as **hemoglobin** and **myoglobin**, reaction mechanisms |
| **3** | To analyze difference between **diastereomers** and **enantiomers**, and the concept of **meso compounds** in chiral systems, how the addition of a common ion affects the solubility and equilibrium position of a salt in solution. |
| **4** | To understand the kinetics of **enzyme-substrate binding** and **transition states**. explore how stereochemistry affects the reactivity. |
| **5** | To interpret properties, and biological activity of carbon compounds in pharmaceuticals, materials science, and biochemistry. |

**Course outcomes:**

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

| CO NO | COURSE OUTCOME | BTL | PO | PSO |
|---|---|---|---|---|
| **CO1** | Remember and describe the stereo chemical properties of organic compounds | **K1** | **PO2** | **PSO1** |
| **CO2** | Understand the basic concepts of enzyme catalysis in rate determination | **K1** | **PO2** | **PSO1** |
| **CO3** | Apply the basic concepts to Determine the order of a chemical reaction | **K2** | **PO7** | **PSO2** |
| **CO4** | Analyze the biological significance of various elements present in the human body. | **K2** | **PO7** | **PSO2** |
| **CO5** | Evaluate the concepts of ionic equilibrium for the qualitative and quantitative analysis | **K3** | **PO7** | **PSO2** |

**For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create**

| CO-PO MATRIX | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| **CO NO** | **PO1** | **PO2** | **PO3** | **PO4** | **PO5** | **PO6** | **PO7** | **PSO1** | **PSO2** |
| **CO1** | | **2** | | | | | | 1 | |
| **CO2** | | **2** | | | | | | 2 | |
| **CO3** | | | | | | | 2 | | 2 |
| **CO4** | | | | | | | **2** | | 2 |
| **CO5** | | | | | | | 2 | | 2 |

**Use the codes 3,2,1 for High, Moderate and Low correlation Between CO-PO-PSO respectively**

## Syllabus

**Course Details**

| Unit | Learning Units | Lecture Hours |
|---|---|---|
| | **GENERAL AND PHYSICAL CHEMISTRY** | |
| **I** | **UNIT-I Stereo chemistry of carbon compounds**<br>Molecular representations - Wedge, Fischer, Newman and Saw-Horse formulae.Optical isomerism: Optical activity- wave nature of light, plane polarised light, optical rotation and specific rotation. Chiral molecules-definition and criteria (Symmetry elements)- Definition of enantiomers and diastereomers – Explanation of optical isomerism with examples-Glyceraldehyde, Lactic acid, Alanine, Tartaric acid, 2,3-dibromopentane.<br>**D,L, R,S and E,Z- configuration with examples.**<br>**Definition of Racemic mixture – Resolution of racemic mixtures ( techniques)** | **9Hrs** |
| **II** | **Unit II Bioinorganic Chemistry**<br>Metal ions present in biological systems, classification of elements according to their action in biological system. Geochemical effect on the distribution of metals, Na / 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, Cisplatin as an anti-cancer drug. Iron and its application in bio-systems, Haemoglobin-transfer of oxygen, Myoglobin-Storage and transfer of iron | **9Hrs** |
| **III** | **Unit III Ionic equilibrium**<br>Strong, moderate and weak electrolytes, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Ionization of weak acids and bases, pH scale, Buffer solutions-Henderson's equation. Indicators-theories of acid – base Indicators, selection of Indicators,<br>Common ion effect Solubility and solubility product of sparingly soluble salts – applications of solubility product principle. | **9Hrs** |
| **IV** | **Unit IV Chemical Kinetics-I:**<br>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 (similar and different reactants). Half–life of a reaction. General methods for determination of order of a reaction | **9Hrs** |
| **V** | **Unit V Chemical Kinetics-II:** | **9Hrs** |

| | | |
|---|---|---|
| | 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).<br>Enzyme catalysis- Specificity, factors affecting enzyme catalysis, Inhibitors and Lock & key model. Michaels- Menten equation- derivation, significance of Michaelis-Menten constant. | |

**III. Reference books**


- Text book of physical chemistry by S Glasstone
- Concise Inorganic Chemistry by J.D.Lee
- Advanced physical chemistry by Gurudeep Raj
- Advanced physical chemistry by Bahl and Tuli
- Inorganic Chemistry by J.E.Huheey
- Basic Inorganic Chemistry by Cotton and Wilkinson.

1.https://www.uou.ac.in/lecturenotes/science/MSCCH-17/CHEMISTRY%20LN%201%20STERIOCHEMISTRY.pdf

2.https://www.deshbandhucollege.ac.in/pdf/resources/1585324665_BSc(H)-BSc-PS-LS-VI-Bioinorganic-2.pdf

3.https://nios.ac.in/media/documents/SrSec313NEW/313_Chemistry_Eng/313_Chemistry_Eng_Lesson12.pdf

4.https://vssut.ac.in/lecture_notes/lecture1425072667.pdf

5.https://chem.libretexts.org/Bookshelves/Physical_and_Theoretical_Chemistry_Textbook_Maps/Physical_Chemistry_(LibreTexts)/29%3A_Chemical_Kinetics_II-_Reaction_Mechanisms

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**Title of the Paper: GENERAL AND PHYSICAL CHEMISTRY**

**Semester: IV** **INTERNAL ASSESMENT QUESTION PAPER**

| | | |
|---|---|---|
| **SET No** | **1** | |
| **Course Code :**<br>**Title of the Course:** | **23CHMIL242**<br>**GENERAL AND PHYSICAL CHEMISTRY** | |
| **Offered to:** | **BSc Hons Chemistry** | |
| **Category:** | **SEMESTER** | **IV** |
| **Max.Marks for IA** | **30** | |
| **Max.Time** | **90 Min** | |

## Section A: Short Answer Questions (10 Marks)

**Answer all questions. Each question carries 5 Marks.**

Q1 (a) Define optical rotation and specific rotation. K1

OR

(b) Define Definition of enantiomers and diastereomer K2

Q2 (a) Explain Excess and deficiency of Hg, Pb and trace metals. K2

OR

(b) Describe Cisplatin as an anti-cancer drug. K2

## Section B: Long Answer Questions (20 Marks)

**Answer All questions. Each question carries 10 Marks.**

Q3 (a) Illustrate optical isomerism with following molecules Glyceraldehyde, Lactic acid, Alanine K3

OR

(b) Draw Wedge, Fischer, Newman and Saw-Horse representations formulae with an example each. K3

Q4 (a) Explain structure, Storage and transfer of oxygen of Haemoglobin K3

OR

(b) i) Classify elements according to their actionin biological system K3

ii) Iron and its application in bio-system

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**Title of the Paper: GENERAL AND PHYSICAL CHEMISTRY**

**Semester: IV**

**SEMESTER -END QUESTION PAPER**

| | |
|---|---|
| **Course Code & Title of the Course:** | **23CHMIL242**<br>**GENERAL AND PHYSICAL CHEMISTRY** |
| **Offered to:** | **BSc Hons Chemistry** |
| **Category:** | **SEMESTER: IV** |
| **Max. Marks** | **70** |
| **Max.Time** | **3 Hrs** |

**Section A: Short Answer Questions (20 Marks)**
**Answer all questions. Each question carries 4 Marks.**

**Answer all questions. Each question carries 4 Marks.**

Q1 (a) Discuss Optical activity with an example K1

OR

(b) Describe optical isomerism of Tartaric acid, 2,3-dibromopentane K1

Q2 (a) Explain Excess and deficiency of Hg, Pb and trace metals. K2

OR

(b) Describe Cisplatin as an anti-cancer drug. K2

Q3 (a) Interpret Henderson's equation K3

OR

(b) Illustrate ionization constant and ionic product of water K3

Q4 (a) Derive integrated rate equationsfor zero order reaction K4

OR

(b) Explain Effect of temperature on reaction rates K4

Q5 (a) Explain activation energy and its calculation from Arrhenius equation K4

OR

(b) Explain Inhibitors and Lock & key model. K4

## Section B: Long Answer Questions (50 Marks)

**Answer all questions. Each question carries 10 Marks.**

Q6 (a) Explan optical isomerism with following molecules Glyceraldehyde, Lactic acid, Alanine K2

OR

(b) Draw Wedge, Fischer, Newman and Saw-Horse representations formulae with an example each. K2

Q7 (a) Explain structure, Storage and transfer of oxygen of Haemoglobin K2

OR

(b) i) Classify elements according to their actionin biological system K2

ii) Iron and its application in bio-systems

Q8 (a) Interpret theories of acid – base Indicators K3

OR

(b) Give note on Common ion effect Solubility and solubility product of sparingly soluble salts and its applications K3

Q9 (a) Derive integrated rate equations for first and second order reaction K4

OR

(b) Explain methods for determination of order of a reaction K4

Q10 (a) Explain Collision theory and Activated Complex theory. K4

OR

(b) Derive Michaels- Menten equation its significance K4

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**Title of the Paper: Physical Chemistry - Volumetric Analysis**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| **Course Code** | | | | **23CHMIP242** | | | |
| **Title of the Course** | | | | **Physical Chemistry - Volumetric Analysis** | | | |
| **Offered to: (Programme/s)** | | | | B.Sc. Hons Chemistry | | | |
| **L** | **0** | **T** | **0** | **P** | **2** | **C** | **1** |
| **Year of Introduction:** | **2024-25** | | | **Semester:** | | | **IV** |
| **Course Category:** | **Minor** | | | **Course Relates to:** | **GLOBAL** | | |
| **Year of Revision:** | **2024** | | | **Percentage:** | **NA** | | |
| **Type of the Course:** | | | | Employability | | | |
| **Crosscutting Issues of the Course :** | | | | Environment and Sustainability | | | |
| **Pre-requisites, if any** | | | | Basic knowledge on volumetric analysis | | | |

**Semester: IV**

**Course Description:**

This course provides an introduction to the principles and techniques of volumetric analysis, focusing on titration methods for determining substance concentrations. Topics include solution preparation, standardization, indicator selection, endpoint detection, and practical applications in environmental, industrial, and pharmaceutical analysis. Emphasis is placed on precision, accuracy, and analytical skills. Suitable for students in chemistry and related fields.

**Course Objectives:**

| S.NO | COURSE OBJECTIVES |
|---|---|
| 1 | Recall the basic principles of volumetric analysis and the types of titrations (e.g., acid-base, redox).List common indicators and their purposes in detecting endpoints. |
| 2 | Explain the processes of preparing and standardizing solutions. Describe the significance of stoichiometric relationships in volumetric analysis. |
| 3 | Perform accurate titrations using laboratory glassware and record observations.Apply volumetric methods to determine the concentration of unknown solutions. |
| 4 | Differentiate between various types of titrations based on their chemical principles. Analyze the factors affecting endpoint detection and titration accuracy. |
| 5 | Design a volumetric analysis experiment to address a specific analytical problem.Develop innovative approaches to improve the efficiency and reliability of titration techniques. |

**Course outcomes:**

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

| CO NO | COURSE OUTCOME | BTL | PO | PSO |
|---|---|---|---|---|
| CO1 | Use glassware, equipment and chemicals and follow experimental procedures in the laboratory | K1 | PO2 | PSO1 |
| CO2 | Understand and explain the volumetric analysis based on fundamental concepts learnt in ionic equilibria | K1 | PO2 | PSO1 |
| CO3 | Apply concepts of a standard solutions, primary and secondary standards in volumetric analysis | K2 | PO1 | PSO1 |
| CO4 | Facilitate the learner to make solutions of various molar concentrations for analyze and estimate the unknown sample | K2 | PO7 | PSO2 |
| CO5 | Evaluate volumetric analysis based on fundamental concepts to determine unknown sample . | K3 | PO1 | PSO2 |

**For BTL: K1: Remember; K2: Understand; K3: Apply; K4: Analyze; K5: Evaluate; K6: Create**

| CO-PO MATRIX | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| CO NO | PO1 | PO2 | PO3 | PO4 | PO5 | PO6 | PO7 | PSO1 | PSO2 |
| CO1 | | 1 | | | | | | 1 | |
| CO2 | | 2 | | | | | | 2 | |
| CO3 | 2 | | | | | | | 2 | |
| CO4 | | | | | | | 2 | | 2 |
| CO5 | 2 | | | | | | | | 3 |

**Use the codes 3,2,1 for High, Moderate and Low correlation Between CO-PO-PSO respectively**

## Syllabus

**Volumetric analysis:**

1.Estimation of sodium hydroxide using standardised HCl solution.

2.Estimation of sodium carbonate and sodium hydroxide present in a mixture.

3.Determination of Fe (II) using KMnO4 with oxalic acid as primary standard. (internal indicator method)

4.Determination of Fe (II) using KmnO4 with oxalic acid as primary standard. (external indicator method)

5.Estimation of of Mg+2 by EDTA (complexometric titration)

6.Determination of first order rate constant by hydrolysis of Ester

III. **Co-curricular activities and assessment methods:**

**1.** Continuous Evaluation: Monitoring the progress of student's learning

**2.** Class Tests, Worksheets 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 andteaching methods adopted by teachers throughout the SEMESTER .

## IV. List of reference books:

**1.** A Text Book of Quantitative Inorganic Analysis(3rd Edition) –A.I.Vogel

**2.** Web related references suggested by teacher.

Web Links:

1.https://www.bdu.ac.in/cde/SLM/B.Sc.%20Chemistry/I%20Year/Major%20Paper%20II%20Practical%20-%20I%20Volumetric%20Analysis.indd.pdf

2. https://allbachelor.com/2021/01/27/1-to-estimate-the-amount-of-naoh-and-na2co3-in-the-given-mixture-of-naoh-and-na2co3/

3. https://www.nsec.ac.in/images/bes_REDOX%20TITRATION.pdf

4. https://kahedu.edu.in/naac/C-3/Additional%20documents/E-content/426.pdf

# A.G. & S.G. Siddhartha Degree College of Arts & Science

Vuyyuru-521165, Krishna District, Andhra Pradesh

(Managed by: Siddhartha Academy of General & Technical Education, Vijayawada-10)

An Autonomous College in the Jurisdiction of Krishna University

**Accredited by NAAC with "A" Grade**

## DEPARTMENT OF Chemistry

# Value Added Course

**Title: "WATER ANALYSIS"**

| | | |
|---|---|---|
| Name of the Lecturer | : | |
| Class | : | II Major Chemistry |
| Duration of the Course | : | Thirty Days |
| VAC Code | : | |

**WATER ANALYSIS**"

**Syllabus**

- INTRODUCTION
- WATER QUALITY PARAMETERS
- BIO CHEMICAL OXYGEN DEMAND (BOD), CHEMICAL OXYGEN DEMAND (COD)& DISSOLVED OXYGEN
- INORGANIC MEASUREMENTS
- ELECTRIC CONDUCTANCE
- HARDNESS CLASSIFICATION OF WATER
- PHYSICAL PARAMETERS
- CHEMICAL PARAMETERS
- ANALISIS OF TURBIDIMETRY
- CATION MEASUREMENTS
- ANION MEASUREMENTS
- INSTRUMENTATION
- RESULT

**Methodology :**

Teaching ,Learning & Practical Methods

**Duration:** 30 Days