Dr. V. S. Krishna Govt. Degree College
(Autonomous)
Visakhapatnam-13

(Affiliated to Andhra University, Visakhapatnam)

Department of Chemistry

Revised Syllabus for B.Sc. Chemistry under CBCS

Board of Studies

2022-23

Dr. V. S. Krishna Govt. Degree College (Autonomous), Visakhapatnam

Recommended Composition of the Board of Studies of chemistry and its functions

(Academic year 2022 – 2023)

Department:Chemistry

Subject:CHEMISTRY(B.Sc.Chemistry)

I Composition

MEMBER	NAME & DESIGNATION
Head of the Department (Chairman)	Dr. A V RAMESH
Faculty Members	1. Dr. Ch. S. Anuradha 2. Dr. M. Gopi 3. Smt. D. S. L. Prasanna 4. Sri. K. Nageswara Rao 5. Dr. N. Sankara Rao 6. Sri. T. Appa Rao 7. Dr. G. Lakshmana Rao 8. Sri. Ch. V. SaiKrishna 9. Sri. Y. Venkatesh 10.Dr. B. Sudhamsa Prabhakar
Subject Expert (University Nominee)	Dr. P. Srinivasa Rao, Associate Professor, School of chemistry, A.U.
Subject Experts (from outside the parent university)	Sri D Adi Narayana Lecturer in Chemistry GDC, Srikakulam (men)
	Sri S Dilleswararao Lecturer in Chemistry GDC, Tuni
Member from Industry	Sri I. Bhaskara Reddy, Plant Head, Admiron Life Sciences, Visakhapatnam.
Member from Alumni	Dr.Dr.Sathish Mohan Botsa, Research Scientist B, NCAOR, Goa
Coordinator, IQAC	Dr. Ch. Lalitha, Lecturer in Micro Biology
Coordinator, Academic Council	Dr. P. Latha, Lecturer in Physics
Chairperson, Academic Council	Dr. I. Vijaya Babu Principal

II. Term.

The term of the nominated members shall be two years.

III. Meeting

The Principal of the College shall draw the schedule for meeting of the Board of Studies for different Departments. The meeting may be scheduled as and when necessary but at least once a year.

IV. Functions

The Board of Studies of a Department in the College shall:

a) Prepare syllabus and various courses keeping in view the objectives of the College interest of the stakeholders and national requirement for consideration and approval of the Academic Council.

b) Suggest methodologies for innovative teaching and evaluation techniques.

c) Suggest panel of names to the Academic Council for appointment of examiners.

d) Coordinate research, Teaching, Extension and other academic activities in the Department/College.

Dr. V. S. Krishna Govt. Degree College (A)
Department of Chemistry

Minutes of board of studies (BOS) meeting 2021-22 on 30. 09. 2022 at 3.00 PM

In pursuance of conferment of Autonomous status to Dr. V. S. Krishna Govt. Degree College (A), Visakhapatnam by the UGC vide letter No. F22-1/2011(AC) dated 20.07.2011 from Dr. Manju Singh, Joint Secretary, UGC, New Delhi and Proceedings No. C-II (1) / Dr. V S Krishna College (A)/ 2022 dt.03.08.2022 of The Vice-Chancellor, Andhra University, Visakhapatnam, the 8th Board of Studies in Chemistry Subject is conducted on 30. 09. 2022 through offline at Dr. V. S. Krishna Govt. Degree College (A), *at 3.00 PM.*

***Venue**: Conference Hall, Dt: 30. 09. 2022, Friday – 3.00 PM.*

Dr.A. V Ramesh, H O D Dept. of chemistry, University NomineeDr. P. Srinivasa Rao, Associate Professor, School of chemistry, A.U.,Subject Expertsi)Sri D Adi Narayana, Lecturer in Chemistry,GDC, Srikakulam (men), ii) Sri S DilleswaraRao,Lecturer in Chemistry, GDC, Tuni, **Member from Industry** *Sri I. Bhaskara Reddy, Plant Head,, Admiron Life SciencesPvt. Ltd., Visakhapatnam.,* **Member from Alumni***Dr.Dr.Sathish Mohan Botsa, Research Scientist B, NCAOR, Goa, Coordinator- IQAC, Dr. Ch. Lalitha, Lecturer in Micro Biology,* **Coordinator, Academic Council** *Dr. P. Latha, Lecturer in Physics,* **Chairperson, Academic Council** *Dr. I. Vijaya Babu, Principal, and all the faculty membersof Chemistry Department attended the meeting.*

Agenda:

- *To discuss the Semester System and Choice Based Credit System (CBCS) being implemented for the past 07 years, i.e., w.e.f. 2015-16.*
- *To discuss and approve the Continuation/Modifications of the syllabus forthe Odd & Even Semesters of I, II & III Years for 2022-23.*
- *Grant of Extra credits for Online SWAYAM MOOCs etc.*
- *Syllabus, Model Question Papers and Model Blue Prints for I, II, III, IV, V and VI Semesters.*
- *Teaching learning methodology by 75:25 (External: Internal) ratio for the present I,II- and III-Year Students w.e.f. 2022-23 as per C I A SOP issued by APCCE.*
- *Panel of paper setters and examiners.*
- *Proposals for Community Service Projects/Extension activities for the benefit of the society.*
- *Department action plan for 2021-22.*
- *To discuss and resolve the minor modifications/refinement if any, in the Chemistry cluster electives CI, CII & CIII as majority of the students opting this clusteras their choice.*

Any Other Proposal with the Permission of the Chairman.

Resolutions:

The following agenda items are discussed and resolutions are made:

1) *To continue the Revised Choice Based Credit System as per the staff council proceedings for the academic year 2022 – 2023 for Semester I, II, III, IV, V and VI of B. Sc Chemistry.students.*
2) *To implement guidelines of academic council and adopt NEP – 2020.*
3) *To approve and implement the newly framed syllabus approved by the B.O.S. for the B. Sc. Degree course in Chemistry with effect from academic year 2022 – 2023. The newly framed syllabus is oriented in such a way that it caters the needs of the students and to meet the present-day employability and to develop professionalism and enhance skills in the field of chemistry.*
4) *To approve and ratify the syllabus of B. Sc. Degree Chemistry for the 2021-22 admitted batch.*
5) *To approve and ratify the 5th, 6th semester syllabus of B. Sc. Degree Chemistry for the 2020-21 admitted batch.*
6) *To continue the semester mode pattern of examinations for Semester I, II, III, IV, V and VI students of the existing B.SC CHEMISTRY. Further it is approved and ratified syllabus, blue print and the model question papers submitted by the concerned faculty members for Semester I, II, III, IV, V and VI.*
7) *To approve the continuous internal assessment pattern in accordance with SOP issued by APCCE.*
8) *To approve and ratify value-added certificate course for the academic year 2022-23 and also To approve and ratify new employability and skill-based programmes from 2022-23.*
9) ***To approve and ratify life skill courses, skill development courses for the 1st and 2nd year students (B.A., B.Com. and B.Sc.) Chemistry and B.Sc Chemistry minors for Physics.***
10) ***To approve and ratify Community Services Project at the end of II semester and internship -1 at the end of IV semester for 2022-23. And also approve and ratify the internship during 6th semester.***
11) ***To approve and ratify question paper blue print which is prepared based on bloom's taxonomy, model question papers for 75external marks and 25 internal marks for core courses.***
12) ***To approve and ratify blue print which is prepared based on bloom's taxonomy and the model question papers for 50 external marks for life skill and skill development courses.***
13) *To approve and ratify list of external examiners.*
14) *To approve suggestions for innovative teaching based on pedagogy and evaluation techniques.*
15) *To approve suggestions for student seminars, workshops and student- centered activities.*
16) *To approve suggestions for research and extension activities or start-ups.*
17) *To encourage students to take up independent research projects at their level by providing facilities.*
18) *To adopt NAAC norms by introducing quality circles among student communities.*
19) *To develop infrastructure facilities, lab facilities in the department and implement guidelines of the academic council.*

20) *To take up ICT mode of teaching and evolve techniques that are easily understood by the students and conduct remedial coaching to the slow learners.*

21) *To encourage students to join JKC to equip with communication and interview skills and improve their personality development.*

22) *To encourage students to participate in the community development activities such as Haritha Krishna Eco Club, Red Ribbon Club, NCC and NSS.*

Signatures of the members

MEMBER	NAME & DESIGNATION	SIGNATURE
Head of the Department (Chairman)	Dr. A V RAMESH	
Faculty Members	1. Dr. Ch. S. Anuradha 2. Dr. M. Gopi 3. Smt. D. S. L. Prasanna 4. Sri. K. Nageswara Rao 5. Dr. N. Sankara Rao 6. Sri. T. Appa Rao 7. Dr. G. Lakshmana Rao 8. Sri. Ch. V. SaiKrishna 9. Sri. Y. Venkatesh 10.Dr. B. Sudhamsa Prabhakar	
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Coordinator, IQAC	Dr. Ch. Lalitha, Lecturer in Micro Biology	
Coordinator, Academic Council	Dr. P. Latha, Lecturer in Physics	
Chairperson, Academic Council	Dr. I. Vijaya Babu Principal	

B. SC. CHEMISTRY

Dr. V. S. Krishna Govt. Degree College (Autonomous), Visakhapatnam

Programme outcomes:

On successful completion of the **B.Sc Chemistry** Programme students are able to:

(i). Understand Systematic and fundamental concepts of chemistry as a discipline

(ii).Acquire Skill and related developments of specialization in the subject.

(iii).Identify chemistry related problems, analysis and application of data using appropriate methodologies.

(iv).Apply subject knowledge and skill to solve complex problems with defined solutions.

(v).Find opportunity to apply subject-related skill for acquiring jobs and self employment.

Programme specific outcomes:

On successful completion of the **B.Sc Chemistry (Honours)** Programme students are able to:

(i).Understand new frontiers of knowledge in chemistry for professional development.

(ii).Apply subject knowledge for solving societal problems related to application of chemistry in day to day life.

(iii).Develop industry focused skills to lead a successful career.

(iv).Express proficiency in oral and written communications to appreciate innovation in research.

STRUCTURE OF B.Sc. CHEMISTRY PROGRAMME (CBCS)

SEM	COURSE CODE	COURSE TITLE	CREDITS (T+P)	MARKS	HRS PER WEEK
I	CHE (H)-CC I	INORGANIC CHEMISTRY I - ATOMIC STRUCTURE & CHEMICAL BONDING	4+1	100+50	4+2
	CHE(H)-CC II	PHYSICAL CHEMISTRY I - STATES OF MATTER & IONIC EQUILIBRIUM	4+1	100+50	4+2
II	CHE(H)-CC III	ORGANIC CHEMISTRY I - BASICS AND HYDROCARBONS	4+1	100+50	4+2
	CHE(H)-CC IV	PHYSICAL CHEMISTRY II - CHEMICAL THERMODYNAMICS AND ITS APPLICATIONS	4+1	100+50	4+2
III	CHE(H)-CC V	INORGANIC CHEMISTRY II – S & P-BLOCK ELEMENTS	4+1	100+50	4+2
	CHE(H)-CC VI	ORGANIC CHEMISTRY II - OXYGEN CONTAINING FUNCTIONAL GROUPS	4+1	100+50	4+2
IV	CHE(H)-CC VII	ORGANIC CHEMISTRY III – HETEROCYCLIC CHEMISTRY	4+1	100+50	4+2
	CHE(H)-CCVIII	PHYSICAL CHEMISTRY III - PHASE EQUILIBRIA AND CHEMICAL KINETICS	4+1	100+50	4+2
	CHE(H)-CC IX	INORGANIC CHEMISTRY III - COORDINATION CHEMISTRY AND GREEN CHEMISTRY	4+1	100+50	4+2
	CHE(H)-CC X	PHYSICAL CHEMISTRY V - QUANTUM CHEMISTRY & SPECTROSCOPY	4+1	100+50	4+2
	CHE(H)-CC XI	ANALYTICAL CHEMISTRY-1	4+1	100+50	4+2

	III B.SC CHEMISTRY SYLLABUS (W.E.F 2022-2023) (To Choose THREE pairs from A,B,C,D,E&F Skill Enhancement Courses				
SEM V	SEC A1 SEC A2	POLYMER CHEMISTRY MEDICINAL CHEMISTRY	4+1 4+1	100+50	4+2 4+2
	SEC B1 SEC B2	BASIC ANALYTICAL METHODS IN CHEMISTRY ELECTRO CHEMISTRY	4+1 4+1	100+50 100+50	4+2 4+2
	SEC C1 SEC C2	NANOSCALE MATERIALS & APPLICATIONS ENVIRONMENTAL CHEMISTRY	4+1 4+1	100+50 100+50	4+2 4+2
	SEC D1 SEC D2	SYNTHETIC ORGANIC CHEMISTRY ANALYSIS OF ORGANIC COMPOUNDS	4+1 4+1	100+50 100+50	4+2 4+2
	SEC E1 SEC E2	NOVEL INORGANIC SOLIDS APPLICATIONS OF COMPUTERS IN CHEMISTRY	4+1 4+1	100+50 100+50	4+2 4+2
	SEC F1 SEC F2	IINDUSTRIAL CHEMISTRY-1 INDUSTRIAL CHEMISTRY-2	4+1 4+1	100+50 100+50	4+2 4+2

CHEMISTRY MINOR COURSE FOR OTHER DEPARTMENT

SEM	COURSE	COURSE CODE	COURSE NAME	CREDITS(T+P)	Hours per week
II	II	CHE(H) GEC-I	Inorganic and general chemistry	4+1	4+3
IV	IV	CHE(H) GEC-II	Physical and Organic chemistry	4+1	4+3

Department of Chemistry
Dr. V. S. Krishna Govt. Degree College (A), Visakhapatnam
SEMESTER – I

CHE(H)-CC-I : INORGANIC CHEMISTRY I - ATOMIC STRUCTURE &CHEMICAL BONDING

(w.e.f. Academic Year 2022-2023)

Credits 4 **60 hrs (4 h / w)**

Learning objectives

On completion of this course, the students will be able to learn:

LO1: Learning scientific theory of atoms, concept of wave function.

LO2: Elements in periodic table; physical and chemical characteristics, periodicity.

LO3: To predict the atomic structure, chemical bonding, and molecular geometry based on accepted models.

LO4: To understand atomic theory of matter, composition of atom.

LO5: Physical and chemical characteristics of elements in various groups and periods according to ionic size, charge, etc. and position in periodic table.

LO6: Characterize bonding between atoms, molecules, interaction and energetics (ii) hybridization and shapes of atomic, molecular orbitals, bond parameters, bond- distances and energies.

LO7: Valence bond theory incorporating concepts of hybridization predicting geometry of molecules.

LO8: Importance of hydrogen bonding, metallic bonding.

Course Outcomes

After completion of the course students are able to understand

CO1: Structure of atom, electronic configuration.

CO2: To know the position of various elements present in different blocks of periodic table.

CO3: To aware the arrangement of electrons in various orbitals leading to screening effect

CO4: To know about nature of bonding and to calculate the bond order.

CHE (H)-CC-I: INORGANIC CHEMISTRY I - ATOMIC STRUCTURE &CHEMICAL BONDING (60 H)

SYLLABUS

Module 1: Atomic Structure **12 H**

Bohr's theory, its limitations and atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and ψ^2. Quantum numbers and their significance. Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of *s*, *p*, *d* and *f* orbitals. Contour boundary and probability diagrams.

Module 2: Periodicity of *s, p, d*- block elements **12 H**

s, *p*, *d*,block elements, the long form of periodic table. Detailed discussion of the followingproperties of the elements, with reference to *s* and *p*-block.

(a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective

nuclear charge in periodic table.
(b) Atomic radii (van der Waals)
(c) Ionic and crystal radii.
(d) Covalent radii (octahedral and tetrahedral)
(e) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy.
(f) Electronegativity, Pauling's/ Mulliken's/ electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization.

Module 3: Periodicity of *f*-block elements **12 H**

f-block elements, the long form of periodic table. Detailed discussion of the followingproperties of the elements, with reference to *s* and *p*-block
(a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table, (b)Atomic radii (van der Waals), (c) Ionic and crystal radii, (d) Covalent radii (octahedral and tetrahedral) (e) Electronegativity.

Chemical bonding-1

(i)*Ionic bond:* General characteristics, types of ions, size effects, radius ratio rule and itsl imitations. Packing of ions in crystals. Born-Landé equation with derivation and importance of Kapustinskii expression for lattice energy. Madelung constant, Born-Haber cycle and its application, Solvation energy.

Module 4: Chemical bonding-2 **16 H**

(ii)*Covalent bond:* Lewis structure, Valence Bond theory (Heitler-London approach).Energetics of hybridization, equivalent and non-equivalent hybrid orbitals. Bent's rule, Resonance and resonance energy, Molecular orbital theory. Molecular orbital diagrams of diatomic and simple polyatomic molecules N2, O2, C2, B2, F2, CO, NO, and their ions; HCl, BeF2, CO2, (idea of s-p mixing and orbital interaction to be given). Formal charge, Valence shell electron pair repulsion theory (VSEPR), shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding (σ and π bond approach) and bond lengths.
Covalent character in ionic compounds, polarizing power and polarizability. Fajan's rules and consequences of polarization.Ionic character in covalent compounds: Bond moment and dipole moment. Percentage ionic character from dipole moment and electronegativity difference.

Module 5: Chemical bonding-3 **8 H**

(iii)*Metallic Bond:* Qualitative idea of valence bond and band theories. Semiconductors and nsulators, defects in solids.
(iv)*Weak Chemical Forces:* van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Repulsive forces, Hydrogen bonding (theories of hydrogen bonding, valence bond treatment)

Reference Books:

1. Lee, J.D. *Concise Inorganic Chemistry* ELBS, 1991.
2. Atkins, P.W. & Paula, J. *Physical Chemistry*, 10th Ed., Oxford University Press, 2014.
3. Rodger, G.E. *Inorganic and Solid-State Chemistry*, Cengage Learning India Edition, 2002.

.CHE(H)-CC-I INORGANIC CHEMISTRY -I LAB

(A) Titrimetric Analysis

(i)Calibration and use of apparatus
(ii)Preparation of solutions of different Molarity/Normality of titrants

(B) Acid-Base Titrations

(i)Estimation of carbonate and hydroxide present together in mixture.

(ii)Estimation of carbonate and bicarbonate present together in a mixture.

(C) Oxidation-Reduction Titrimetry

(i)Estimation of Fe(II) and oxalic acid using standardized KMnO4 solution.

(ii)Estimation of oxalic acid and sodium oxalate in a given mixture.

(iii)Estimation of Fe(II) with K2Cr2O7 using internal **external** (diphenylamine, anthranilic acid) and external indicator.

Reference text:

1. Mendham, J., A. I. Vogel's *Quantitative Chemical Analysis 6^{h}Ed.*, Pearson, 2009.

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CHE (H)-CC-I: INORGANIC CHEMISTRY I - ATOMIC STRUCTURE &CHEMICAL BONDING (60 H)

The Semester question paper consists of 2 sections.

PART-A: Consists of EIGHT short answer questions carries 5 marks out of which 5 are to be answered.

PART- B: Consists of FIVE internal choice essay questions. Each question carries 10 marks.

The examiner has to choose 2 questions from each Module

The examiner is requested to set question in such a way that the entire syllabus is reflected in the question paper set by him.

MODULE	5 MARKS QUESTIONS	QUESTION SERIAL NUMBER	10 MARKS QUESTIONS	QUESTION SERIAL NUMBER	TOTAL MARKS
1	2	1,2	1 (1 OUT OF 2 INTERNAL CHOICE)	9 a or 9 b	20
2	2	3,4	1 (1 OUT OF 2 INTERNAL CHOICE)	10 a or 10 b	20
3	1	5	1 (1 OUT OF 2 INTERNAL CHOICE)	11 a or 11 b	15
4	2	6,7	1 (1 OUT OF 2 INTERNAL CHOICE)	12 a or 12 b	20
5	1	8	1 (1 OUT OF 2 INTERNAL CHOICE)	13 a or 13 b	15

Weightage for each level of Bloom's Taxonomy

Bloom's Taxonomy level	Type of question	Weightage
Knowledge /Remember	(Define/ list/state) type.	30 marks
Comprehension/Understand	(Classify, describe, discuss, identify, explain, report) type	20 marks
Application	(Solve, Sketch, interpret) type. Sums& Mechanisms	10 marks
Analysis	(Differentiate, distinguish, Compare) type.	20 marks
Evaluation	Argue, Defend, judge,	10marks
Create	Derive, Design, construct, Develop, formulate, investigate	

DR. V. S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM

MODEL PAPER – 1

B. Sc, DEGREE FIRST YEAR EXAMINATIONS

Paper-I, SEMESTER-I

CHE (H)-CC-I : INORGANIC CHEMISTRY I- ATOMIC STRUCTURE &CHEMICAL BONDING

Time: 3 hours **Maximum Marks: 75**

PART-A

Answer any **FIVE** of the following questions. **5 X 5 = 25 Marks**

1. Explain Heisenberg uncertainty principle.
2. Write about the shapes of the s, p, d and f orbitals.
3. Write the variation of effective nuclear charge in periodic table.
4. Define ionization enthalpy and electro negativity.
5. Explain Slater rules.
6. Definebent's rule.
7. Write the postulates of valence shell electron pair repulsion theory
8. Write about semiconductors.

PART – B

Answer **ALL** the questions **5 X 10 = 50 Marks**

9. a)Wright the Bohrs theory, Its limitations and atomic Spectra of hydrogen atom.

(OR)

b) Deriveschrodinger's wave equationand explain the significance of PSI and Square.

10. a) Explain the followingi) atomic radii ii)ionic radii iii) Covalent radii

(OR)

b) Define electronegativity? Wright about electronegativity scales.

11. Write any three properties of f block elements?

(OR)

b) Explain Born-haber cycle and write its applications.

12. a)Explain about Valency Bond Theory

(OR)

b)Explain MO diagrams of the following molecules.i) N2 ii) NO

13. a) Explain qualitative idea of band theories.

(OR)

b) Explain the following i) Vander Waal forces ii) Hydrogen bonding.

DR. V. S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM

MODEL PAPER – 2

B. Sc, DEGREE FIRST YEAR EXAMINATIONS

Paper-I, SEMESTER-I

CHE(H)-CC-I : INORGANIC CHEMISTRY I- ATOMIC STRUCTURE &CHEMICAL BONDING

Time: 3 hours **Maximum Marks: 75**

PART-A

Answer any **FIVE** of the following questions. **5 X 5 = 25 Marks**

1. Explain DeBrogli's dual nature of matter.
2. Explain normalized and orthogonal wavefunctions.
3. Write the variation of atomic radius in the periodic table.
4. Write about ionic bond.
5. Explain Slater rules for f block elements.
6. Discuss about fajan's rules.
7. Draw the MO diagram for CO molecule.
8. Discuss about ion dipole forces.

PART – B

Answer **ALL** the questions **5 X 10 = 50 Marks**

9. a)Wright the Bohrs theory, Its limitations and atomic Spectra of hydrogen atom.

(OR)

b)Discuss about quantum numbers and their significance.

10. a) Define Ionization enthalpy? Write the factors which effects Ioionization Energy.

(OR)

b) Define electronegativity? Wright about electronegativity scales.

11. Write any three properties of f block elements?

(OR)

b)Derive Born lande equation and importance of kapustinski expression for lattice energy.

12. a) Discuss about valency shell electron pair repulsion theory.

(OR)

b)Explain Main postulates of MO theory and write MO diagram for O2+

13. a)Explain qualitative idea of valency bond theory for metallic bond.

(OR)

b) Explain the following i) Vander Waal forces ii) Hydrogen bonding.

Dr. V. S. Krishna Govt. Degree College (A), Visakhapatnam

SEMESTER I

CHE(H)-CC-II: Physical Chemistry I - States of Matter & Ionic Equilibrium

(w.e.f. Academic Year 2022-2023)

Credits 4 **60 hrs (4 h / w)**

Learning objective:

On completion of this course, the students will be able to understand:

1. Familiarization with various states of matter.
2. Physical properties of each state of matter and laws related to describe the states.
3. Calculation of lattice parameters.
4. Electrolytes and electrolytic dissociation, salt hydrolysis and acid-base equilibria.
5. Understanding Kinetic model of gas and its properties.
6. Maxwell distribution, mean-free path, kinetic energies.
7. Behavior of real gases, its deviation from ideal behavior, equation of state, isotherm, and law of corresponding states.
8. Liquid state and its physical properties related to temperature and pressure variation.
9. Properties of liquid as solvent for various household and commercial use.
10. Solids, lattice parameters – its calculation, application of symmetry, solid characteristics of simple salts.
11. Ionic equilibria – electrolyte, ionization, dissociation.
12. Salt hydrolysis (acid-base hydrolysis) and its application in chemistry.

Course Outcomes:

After completion of the course students are able to learn about:

1. Behavior of gases.
2. Symmetry elements and indices.
3. Electrolytes, degree of ionization and about buffer solutions.
4. Calculation of P^H values of Buffers
5. Indentify suitable indicators for titrations
6. Calculations the physical parameters like surface tension and viscosity.

CC-2 PHYSICAL CHEMISTRY I - States Of Matter & Ionic Equilibrium (60h) Syllabus

Module 1: Gaseous state: **15h**

Kinetic molecular model of a gas: postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path and viscosity of gases, relation between mean free path and coefficient of viscosity, calculation of σ from η; variation of viscosity with temperature and pressure.

Molecular velocities (average, root mean square and most probable) and average kinetic energy.

Behaviour of real gases: Deviations from ideal gas behaviour, compressibility factor, Z, and its variation with pressure for different gases. Causes of deviation from ideal behaviour. van der Waals equation of state, its derivation and application in explaining real gas behavior.

Module 2: Liquid state **10h**

Qualitative treatment of the structure of the liquid state; physical properties of liquids; vapour pressure, surface tension and coefficient of viscosity, and their determination. Temperature variation of viscosity of liquids. Qualitative discussion of structure of water.

Module 3: Solid state **15h**

Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, powder pattern method.

Module 4 : Ionic equilibria-1 **10h**

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, common ion effect.

Salt hydrolysis-calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Buffer solutions- derivation of Henderson equation and its applications; and applications of buffers in analytical chemistry.

Module 5: Ionicequilibria-2 **10h**

Solubility and solubility product of sparingly soluble salts – applications of solubility product principle. Qualitative treatment of acid – base titration curves (calculation of pH at various stages). Theory of acid–base indicators; selection of indicators and their limitations.

Reference Books:

1. Atkins, P. W. & Paula, J. de *Atkin's Physical Chemistry* 10th Ed., Oxford University Press (2014).
2 Ball, D. W. *Physical Chemistry* Thomson Press, India (2007).
3. Castellan, G. W. *Physical Chemistry* 4th Ed. Narosa (2004).
4. Mortimer, R. G. *Physical Chemistry* 3rd Ed. Elsevier: NOIDA, UP (2009).

2: PHYSICAL CHEMISTRY -I LAB

Hours per week: 2 Credits: 1 Continuous Evaluation: 50 marks

1.Surface tension measurements.

Determination of the surface tension by drop number method.

2.Viscosity measurement using Ostwald's viscometer.

Determination of viscosity of aqueous solutions of (i) ethanol and (ii) sugar at room temperature.

3.Indexing of a given powder diffraction pattern of a cubic crystalline system.

4.pH metry

a. Study the effect on pH of addition of HCl/NaOH to solutions of acetic acid, sodium acetate and their mixtures.

b. Preparation of buffer solutions of different pH

i.Sodium acetate-acetic acid

ii.Ammonium chloride-ammonium hydroxide

c. pH metric titration of (i) strong acid vs. strong base, (ii) weak acid vs. strong base.

d. Determination of dissociation constant of a weak acid.

Reference Books

1. Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry,* R. Chand & Co.: New Delhi (2011).
2. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. *Experiments in Physical Chemistry 8th Ed.*;

BLUE PRINT

Course: CHE(H)-CC-II: Physical Chemistry I - States Of Matter & Ionic Equilibrium

Important Tips for Setting Question Paper

- ✔ The examiner is requested to set question in such a way that the entire syllabus is reflected in the question paper set by him.
- ✔ It is suggested that the question writer should use his/her judgment in assigning difficulty value to each question. Following scale should guide you to set questions at different difficulty levels and use the **Bloom's Taxonomy**action verbs given below.

Bloom's Level	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating
% of Weightage	30	20	20	15	10	5

Question Paper Pattern

- ✔ The Semester question paper consists of 2 sections.

  PART-A: Consists of **EIGHT** short answer questions carries **5** marks out of which **5** are to be answered.

  PART- B: Consists of **FIVE** internal choice essay questions. Each question carries **10** marks.
- ✔ The examiner has to choose **2** questions from each module.

Sl. No	Modules	Name of the Module	5 M Questions	Question Serial Number	10 M Questions	Question Serial Number	Weightage per Module
1	Module 1	Gaseous state	2	1, 2	2	9 (a) or 9 (b)	20 Marks
2	Module 2	Liquid State	1	3	2	10 (a) or 10 (b)	15 Marks
3	Module 3	Solid state	2	4,5	2	11 (a) or 11 (b)	20 Marks
4	Module 4	Ionic Equilibria -I	2	6, 7	2	12 (a) or 12 (b)	20 Marks
5	Module 5	Ionic Equilibria -II	1	8	2	13 (a) or 13 (b)	15 Marks

MODEL PAPER

Dr. V. S Krishna Govt. Degree College, Visakhapatnam (A)

I B.Sc Chemistry Hons, DEGREE FIRST YEAR EXAMINATIONS

Paper –II (CC-II) , SEMESTER- I

(Physical Chemistry I - States of Matter &Ionic Equilibrium)

Time: 3 hours **Maximum Marks:** 75Marks

PART- A

Answer any **FIVE** of the following questions **5x5 = 25Marks**

1. Write collision diameter.
2. Define average and root mean square velocities.
3. Write short notes on vapour pressure.
4. Explain law of constancy of inter facial angles.
5. Explain miller indices.
6. Define degree of ionization.
7. Write about common ion effect.
8. Write about solubility product.

PART- B

Answer **ALL** the questions **5x10 = 50 Marks**

9. (a)Write the Bohrs theory, its limitations and atomic spectrum of H-atom.

(OR)

(b) Derive Schrodinger's wave equation and explain significance of Ψ and Ψ^2 .

11. (a) Explain the following

i) Atomic radii (ii) ionic radii (iii) covalent radii

(OR)

(a)Define electro negativity? Write about electro negativity scales.

11.(a)Write any three properties f block elements.

(OR)

(b)Explain Born Haber cycle and write its applications.

12. (a) Explain about VBT (Heitler- London approach).

(OR)

(c) Explain Molecular orbital Diagrams : (i) N_2 (ii) CO of molecules

13.(a)Explain qualitative idea of band theories.

(OR)

Explain the following.

(i) Vander waals forces (ii)Hydrogen bonding.

Department of Chemistry
Dr. V. S. Krishna Govt. Degree College (A), Visakhapatnam
SEMESTER – II
CHE(H)-CC-III ORGANIC CHEMISTRY 1- BASICS AND HYDROCARBONS
(w.e.f. Academic Year 2022-2023)

Credits 4 **60 hrs (4 h / w)**

Learning objectives

On completion of this course, the students will be able to learn:

LO1: Different types of hybridizations, Homolytic and Heterolytic fission
LO2: Types of organic reactions
LO3: Various projection formulae, stereo isomerism.
LO4: Preparations and chemical reactions of alkanes and alkenes,
LO5: The importance of aromaticity.

Course Outcomes

After completion of the course students are able to understand

CO1: Different types of hybridizations, fissions and Types of organic reactions
CO2: preparations and chemical properties of alkanes, alkenes and alkynes
CO3: Stability of cyclo alkanes.
CO4: Electrophilic aromatic substitution
CO5: The differentiation between alkanes, alkenes and alkynes

CHE(H)-CC-III ORGANIC CHEMISTRY I-BASICS AND HYDROCARBONS(60H)

SYLLABUS

Module 1: Basics of Organic Chemistry **11H**

Organic Compounds: Classification, Nomenclature and hybridization.

Electronic Displacements: Inductive,Electromeric, resonance and mesomeric effects, hyperconjugation, dipole moment.

Homolytic and Heterolytic fission with suitable examples. Electrophiles and Nucleophiles, Nucleophilicity and basicity, Types, shape and their relative stability of Carbocations,Carbanions,Free radicals and Carbenes.

Introduction to types of organic reactions and their mechanism: Addition, Elimination and Substitution reactions (only Basics).

Module 2: Stereochemistry **12H**

Fischer Projection, Newmann and Sawhorse Projection formulae and interconversions. Geometrical isomerism: cis-trans and, syn-anti isomerism E/Z notations.

Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers,Molecules with two or more chiral-centres, Distereoisomers, meso structures. Calculation of number of possible optical isomers for 2,3-dibromo pentane, Tartaric acid and 2,3,4-trihydroxy glutaric acid.Racemic mixture andResolution Relative and absolute configuration: D/L and R/S designations.

Module 3: Chemistry of Aliphatic Hydrocarbons-1 **10H**

Carbon-Carbon sigma bonds

Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Corey House synthesis, Isomerism and its effect on physical properties,Free radicalSubstitutions: Halogenation. Concept of relative reactivity v/s selectivity.

Carbon-Carbon Pi bonds

Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, ElCBReactions. Saytzeff and Hofmann eliminations.

Module 4: Chemistry of Aliphatic Hydrocarbons-2 **15H**

Reactions of alkenes: Electrophilic additions their mechanisms (Markownikoff Anti Markownikoff addition), 1,2-and 1,4-addition reactions in conjugated dienes and Diels-Alder reaction.

Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions Hydration to form carbonyl compounds, Alkylation of terminal alkynes.

Cycloalkanes and Conformational Analysis

Types of cycloalkanes and their relative stability, Baeyer strain theory, Conformation analysis ofAlkanes Relative stability. Energy diagrams of cyclohexane: Chair, Boat and Twist boat forms.

Module 5: Aromatic Hydrocarbons **12H**

Aromaticity: Hückel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Electrophilic aromatic substitution: halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism Directing effects of the groups.

Reference Books:

1. Solomons, T.W G., Fryhle, B. Craig. Organic Chemistry, John Wiley & Sons, Inc (2009).
2. Pine S. H. Organic Chemistry, Fifth Edition, McGraw Hill, (2007)
3. Finar, I. L. Organic Chemistry (Volume 1), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. Eliel, E. L. & Wilen, S. H. Stereochemistry of Organic Compounds; Wiley: London, 1994.
5. Morrison, R. N. & Boyd, R. N. Organic Chemistry, Dorling Kindersley (India) Pvt. Ltd.(Pearson Education).
6. Kalsi, P. S. Stereochemistry Conformation and Mechanism, New Age International, 2005.
7. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning India Education. 2013.

CHE(H)-CC-III ORGANIC CHEMISTRY -I LAB

1. Checking the calibration of the thermometer
2. Purification of organic compounds by crystallization using the following solvents.
   a. Water b.Alcohol c. Alcohol-Water
3. Determination of the melting points of above compounds and unknown organic compounds
4. Determination of boiling point of liquid compounds Chromatography
5. Chromatography (TLC)
   a. Separation of a mixture of two amino acids by ascending and horizontal paper chromatography.
   b. Separation of a mixture of two sugars by ascending paper chromatography
   c. Separation of a mixture of o-and p-nitrophenol or o-and p-aminophenol by thin layer chromatography.

Reference Books

1. Mann, F G & Saunders, BC Practical Organic Chemistry, Pearson Education (2009)
2. Furniss, BS, Hannaford, A.J., Smith, PWG.; Tatchell, AR Practical Organic Chemistry, 5th Ed., Pearson (2012)

BLUE PRINT

Course: CHE(H)-CC-III: Organic Chemistry – 1: Basics and Hydrocarbons

❖ **Important Tips for Setting Question Paper**

✔ The examiner is requested to set question in such a way that the entire syllabus is reflected in the question paper set by him.

✔ It is suggested that the question writer should use his/her judgment in assigning difficulty value to each question. Following scale should guide you to set questions at different difficulty levels and use the **Bloom's Taxonomy**action verbs given below.

Bloom's Level	**Remembering**	**Understanding**	**Applying**	**Analyzing**	**Evaluating**	**Creating**
% of Weightage	30	20	20	15	10	5

Question Paper Pattern

✔ The Semester question paper consists of 2 sections.

PART-A: Consists of **EIGHT** short answer questions carries **5** marks out of which **5** are to be answered.

PART- B: Consists of **FIVE** internal choice essay questions. Each questioncarries **10** marks.

✔ The examiner has to choose **2** question from each module.

Sl. No	**Modules**	**Name of the Module**	**5 M Questions**	**Question Serial Number**	**10 M Questions**	**Question Serial Number**	**Weightage per Module**
1	Module 1	Basics of Organic Chemistry	2	1, 2	2	9 (a) or 9 (b)	20 Marks
2	Module 2	Stereochemistry	2	3, 4	2	10 (a) or 10 (b)	20 Marks
3	Module 3	Chemistry of Aliphatic Hydrocarbons-1	1	5	2	11 (a) or 11 (b)	15 Marks
4	Module 4	Chemistry of Aliphatic Hydrocarbons-2	2	6, 7	2	12 (a) or 12 (b)	20 Marks
5	Module 5	Aromatic Hydrocarbons	1	8	2	13 (a) or 13 (b)	16 Marks

DEPARTMENT OF CHEMISTRY

DR. V. S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM

MODEL PAPER – 1

B. Sc, DEGREE FIRST YEAR EXAMINATIONS

Paper-III, SEMESTER-II

CHE(H)-CC-III ORGANIC CHEMISTRY I-BASICS AND HYDROCARBONS

Time: 3 hours **Maximum Marks: 75**

PART-A

5 X 5 = 25 Marks

Answer any **FIVE** of the following questions.

1. Define homolytic and heterolytic fission with suitable examples.
2. Explain the fundamental difference between nucleophilicity and basicity.
3. Define enantiomers and give examples.
4. Give the Fischer and Newmann projections of tartaric acid.
5. What is Wurtz reaction? Explain with example.
6. What is Markonikov's rule? Explain with suitable example.
7. Write short note on acidity of alkynes.
8. Define the ortho, para and meta directing groups and give examples.

PART-B

5 X 10 = 50 Marks

Answer **ALL** the questions.

9 (a) Explain substitution reactions with suitable examples.

(or)

(b) Define inductive effect and write its applications.

10 (a) Explain geometrical isomerism with suitable examples.

(or)

(b)Explain R-S configuration with suitable examples.

11 (a) Explain the photochemical Halogenation of alkanes with mechanism.

(or)

(b) Explain the Saytzeff and Hofmann eliminations.

12 (a) Explain 1,2- & 1,4- HBr addition reactions of 1, 3-butadiene with mechanism.

(or)

(b) Discuss Bayer's strain theory.

13 (a) Define Huckel's rule and explain the aromaticity of arenes, carbocations and carbanions with suitable examples.

(or)

(b) Explain the mechanisms of nitration and Friedel-Craft's alkylation of benzene.

B.Sc -CHEMISTRY - SEMESTER-II

CC-IV PHYSICAL CHEMISTRY II – CHEMICAL THERMODYNAMICS AND ITS APPLICATIONS

(w.e.f. Academic Year 2022-2023)

Credits 4 **60 hrs (4 h / w)**

Learning objectives

Learning objective:

On completion of this course, the students will be able to understand:

1. The laws of thermodynamics.
2. The changes of thermodynamic properties in the expansion of ideal an ideal gas.
3. Concepts of internal energy,entropy.
4. The change in heat with the temperature
5. Gibb's Helmholtz equqtion and Maxwell relations
6. Concept of Fugacity.
7. Lowering of vapourpressure,elevation of boiling point,etc., and their relation with the amountof solute.
8. Abnormal colligative properties of dilute solutions and van't Hoff factor

MODULE-I: Chemical Thermodynamics -1

Intensive and extensive variables; state and path functions; isolated, closed and open systems; zeroth law of thermodynamics.

First law: Concept of heat, *q*, work, *w*, internal energy, *U*, and statement of first law;enthalpy, *H* ,Expansion of ideal gases and changes in thermodynamic properties. relation between heat capacities(ideal) under isothermal and adiabatic conditions.

Skill component:

Students are able to know about first law of thermodynamics.

MODULE-II: Chemical Thermodynamics -2

Thermochemistry: Heats of reactions: standard states; enthalpy of formation of molecules andions;Variation of Enthalpy of a Reaction with Temperature: The Kirchhoff Equation.

calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data.

Second Law: Concept of entropy; thermodynamic scale of temperature, statement of thesecond law of thermodynamics; Calculation of entropy change for reversible and irreversible processes.

Skill component:

Students are able to learn about second law of thermodynamics.

MODULE-III: Chemical Thermodynamics -3

*Third Law:*Nernst Heat TheoremStatement of third law, concept of residual entropy, calculation of absoluteentropy of molecules.

Free Energy Functions: Gibbs and Helmholtz energy; variation of S, G, A with T, V, P; Freeenergy change and spontaneity. Gibbs-Helmholtz equation; Maxwell relations; thermodynamic equation of state.

Skill component:

Students are able to understand the third law of thermodynamics

MODULE-IV: Chemical Equilibrium:

Thermodynamic properties of open systems – Chemical potential - concept of fugacity. Criteria of thermodynamic equilibrium, degree of advancement of reaction, chemical equilibria in ideal gases, Thermodynamic derivation of relation between Gibbs free energy of reaction and reaction quotient. Free energy of mixing and spontaneity; thermodynamic derivation of relations between the various equilibrium constants *Kp* ,*Kc* and *Kx*. Le Chatelier principle (quantitative treatment);

Skill component:

Students are able know about Le Chatlier principle.

MODULE-V:Solutions and Colligative Properties:

Dilute solutions; lowering of vapour pressure, Raoult's and Henry's Laws and their applications. Derive relations between the four colligative properties [(i) relative lowering of vapour pressure, (ii) elevation of boiling point, (iii) Depression of freezing point, (iv) osmotic pressure] and amount of solute. Derivation of relations between the four colligative properties and molar mass of the solute. Abnormal behavior of solutions.

Skill component:

Students are able to learn about colligative properties.

Course Outcomes:

After completion of the course students are able to learn about:

1. zeroth law of thermodynamics, Concept of heat, work,internal energy, *U*,
2. Concept of entropy; Gibbs and Helmholtz energy.
3. Le Chatlier principle.
4. Depression of freezing point, osmotic pressure
5. The abnormal colligative properties of solutions and nature of solutes.

Reference Books

1. Peter, A. & Paula, J. de. *Physical Chemistry* 10th Ed., Oxford University Press (2014).
2. McQuarrie, D. A. & Simon, J. D. *Molecular Thermodynamics* Viva Books Pvt. Ltd.: New Delhi (2004).
3. Levine, I .N. *Physical Chemistry* 6th Ed., Tata Mc Graw Hill (2010).
4. Metz, C.R. *2000 solved problems in chemistry* ,Schaum Series (2006).

CC-4 : PHYSICAL CHEMISTRY - LAB

Hours per week: 3 Credits: 2 Continuous Evaluation: 100 marks

1. Determination of heat capacity of the calorimeter and enthalpy of neutralization of hydrochloric acid with sodium hydroxide.
2. Calculation of the enthalpy of ionization of ethanoic acid.
3. Determination of heat capacity of the calorimeter and integral enthalpy (endothermic and exothermic) solution of salts.
4. Determination of basicity/proticity of a polyprotic acid by the thermochemical method in terms of the changes of temperatures observed in the graph of temperature versus time for different additions of a base. Also calculate the enthalpy of neutralization of the first step.
5. Determination of enthalpy of hydration of copper sulphate.
6. Study of the solubility of benzoic acid in water and determination of ΔH.

Reference Books

- Khosla, B. D.; Garg, V. C. & Gulati, A., *Senior Practical Physical Chemistry*, R. Chand & Co.: New Delhi (2011).
- Athawale, V. D. & Mathur, P. *Experimental Physical Chemistry* New Age International:

BLUE PRINT

❖ **Important Tips for Setting Question Paper**

✔ The examiner is requested to set question in such a way that the entire syllabus is reflected in the question paper set by him.

✔ It is suggested that the question writer should use his/her judgment in assigning difficulty value to each question. Following scale should guide you to set questions at different difficulty levels and use the **Bloom's Taxonomy** action verbs given below.

Bloom's Level	**Rememberin g**	**Understandin g**	**Applyin g**	**Analyzin g**	**Evaluatin g**	**Creatin g**
% of Weightag e	30	20	20	15	10	5

✔ The Semester question paper consists of 2 sections.
PART-A: Consists of **EIGHT** short answer questions carries **5** marks out of which **5** are to be answered.
PART- B: Consists of **FIVE** internal choice essay questions. Each questioncarries **10** marks.

✔ The examiner has to choose **2** question from each module.

MODULE	SOHORT ANSWER TYPE QUESTIONS (5 MARKS)	WEIGHTAGE (IN MARKS)	LONG ANSWER TYPE QUESTIONS (10 MARKS)	WEIGHTAGE (WEIGHTAGE IN MARKS)	TOTAL WEIGHTAGE (IN MARKS)
Module -I **Thermodynamics -1**	1	5	1	10	15
Module -II **Thermodynamics -2**	1	5	1	10	15
Module -III **Thermodynamics -3**	2	10	1	10	20

Module -IV **Chemical Equilibrium**	2	10	1	10	20
Module -V **Dilute Solutioins**	2	10	1	10	20

MODEL PAPER

B. Sc, DEGREE YEAR EXAMINATIONS

PAPER IV, SEMESTER-II

CHE(H)-CC-IV PHYSICAL CHEMISTRY II - CHEMICAL THERMODYNAMICS AND ITS APPLICATIONS

Time: 3 hours Maximum Marks: 75

PART- A 5 X 5 = 25 Marks

Answer any **FIVE** of the following questions. Each carries **FIVE** marks

1. Explain zero law of thermodynamics.
2. Write a short note on concept of entropy.
3. What is Gibbs' Helmholtz equation.
4. Explain Raoult's law.
5. Describe chemical equilibria in ideal gases and concept of fugacity
6. Write a short note on Henry's law.
7. Explain enthalpy and relation between heat capacities under isothermal and adiabatic condition.
8. Write about thermodynamic equation of state.

PART- B 5X 10 = 50 Marks

Answer **ALL** the questions. Each carries **TEN** marks

9 (a).Give a detailed note on isolated, closed and open systems .

(or)

(b) State and derive first law of thermodynamics.

10 (a)Discuss the calculation of bond energy, bond dissociation and resonance energy from thermo chemical data.

(or)

(b). State and derive Second law of thermodynam

11. (a) State and derive third law of thermodynamics.

(or)

(b) Describe Maxwell relations.

12.(a). Derive the thermodynamic relation between Gibbs, free energy of reaction and reaction quotient.

(or)

(b). Expalin Le-Chatler's principle.

13.(a). Derive the relation between elevation of boing point and amount of solute. .

(or)

(b) Discuss the relation between osmotic pressure and the amount.

DEPARTMENT OF CHEMISTRY
DR. V. S KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM
SYLLABUS FOR B. Sc.Chemistry SEMESTER – 3, - C. C.-5
INORGANIC CHEMISTRY II-S & P-BLOCK ELEMENTS
(w.e.f. Academic Year 2022-2023)

Credits: 4 **Teaching Hours: 60 Hours (4h / W)**

Learning objective:

1. Learn the fundamental principles of metallurgy and methods of extraction and purification of metals.
2. Apply the thermodynamic concepts like that of Gibbs energy and entropy to the principles of extraction of metals.
3. Understands the Bronsted-Lowry and Lewis acid-base concept.
4. Understand the periodicity in melting point, atomic and ionic radii, electron gain enthalpy, and ionization enthalpy, electronegativity of s and p block elements.
5. Understands the Allotropy and catenation properties of s and p block elements.
6. Describes the Nature of bonding in noble gas compounds.
7. Discuss the synthesis and structural aspects of inorganic polymers

Course Outcomes:

After completion of the course students are able to:

CO1. Explain the concepts of metallurgy

CO 2: Explain the Bronsted-Lowry and Lewis acid base theories.

CO3: Describe the hard and soft acids and bases (HSAB) theory and interprets the stability of compounds based on HSAB.

CO4. Describe the Structure, bonding, preparation, properties and uses of Boric acid and borates, boron nitrides, borohydrides (diborane) carboranes, silanes etc.,

CO5. Explain Preparation and properties of XeF_2, XeF_4 and XeF_6

CO6. Describe Synthesis, structural aspects and applications of silicones, phosphazenes, and Polysulphates.

SEMESTER-III- CHE(H)-CC-V INORGANIC CHEMISTRY II-S & P-BLOCK ELEMENTS

Module-1: General Principles of Metallurgy 15H

Chief modes of occurrence of metals based on standard electrode potentials. Methods for purification and concentration of ores. Redox equations, Standard Electrode Potential and its application to inorganic reactions.

Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agent. Electrolytic Reduction, Hydrometallurgy. Methods of purification of metals: Electrolytic Kroll process, Parting process, and Zone refining.

Module-II: Acids and Bases 10 H

Brönsted-Lowry concept of acid-base reactions, solvated proton, relative strength of acids, types of acid-base reactions, levelling solvents, Lewis acid-base concept, Classification of Lewis acids, Hard and Soft Acids and Bases (HSAB) Application of HSAB principle.

Qualitative treatment of acid – base titration curves (calculation of pH at various stages). Theory of indicators; selection of indicators and their limitations. Multistage equilibria in polyelectrolytes.

Module-III: Chemistry of s and p Block Elements 15H

Diagonal relationship. Anomalous behaviour of first member of each group. Allotropy and catenation. Complex formation tendency of s and p block elements. Hydrides and their classification ionic, covalent and interstitial.

Study of the following compounds with emphasis on structure, bonding, preparation, Properties and uses.Boron nitrides, diborane, silanes, Oxides and oxoacids of nitrogen, and Phosphorus. Peroxo acids of sulphur, Interhalogen compounds.

Module-IV: Noble Gases 10H

Occurrence, separation and uses, rationalization of inertness of noble gases, Clathrates; preparation and properties of XeF_2, XeF_4 and XeF_6: Nature of bonding in noble gas compounds (Valence bond treatment and MO treatment for XeF_2).

Module-V: Inorganic Polymers 10 H

Classification of inorganic polymers, General properties of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones and siloxanes. Phosphonitrilic chloride or phosphazenes

CHE(H)-CC-V - INORGANIC CHEMISTRY-II LAB(30 Hours)

Hours per week: 2 Evaluation: 50 marks Credits: 1

(A) Iodo/Iodimetric Titrations

(i) Estimation of Cu(II) and $K_2Cr_2O_7$ using sodium thiosulphate solution (Iodimetrically).

(ii) Estimation of available chlorine in bleaching powder iodometrically.

(B) Inorganic preparations

(i) Cuprous Chloride, Cu_2Cl_2

(ii) Preparation of Manganese (III) phosphate, $MnPO_4.H_2O$

(iii) Preparation of Aluminium potassium sulphate $KAl(SO_4)_2.12H_2O$ (Potash alum) or Chrome alum.

Reference Books:

Theory

1. Lee, J.D. Concise Inorganic Chemistry, ELBS, 1991.

2. Cotton, F.A. & Wilkinson, G. Advanced Inorganic Chemistry, Wiley, VCH, 1999.

3. Huheey, J. E.; Keiter, E. A.; Keiter, R. L.; Medhi, O. K., Inorganic Chemistry: Principles of Structures and Reactivity, 4th Ed., Pearson Education India (2006).
4. Puri, B. R.; Sharma, L. R.; Kalia, K. C., Principles of Inorganic Chemistry, 33rd Ed., Vishal Publishing (2017).
5. Atkins, P.; Overton, T.; Rouke, J.; Weller, M.; Armstrong, F.; Hagerman, M., Shriver Atkins's Inorganic Chemistry, 6th Ed., Oxford University Press India (2015).

Practical

1. Vogel's Text book of Quantitative Chemical Analysis , Pearson Education; 6th edition-2009.
2. Raj, G., Advanced Practical Inorganic Chemistry, Krishna Prakashan, Meerut (2013).
3. Mendham, J.; Denney, R. C., Barnes, J. D.; Thomas, M.; Sivasankar, B., Vogel's Quantitative Chemical Analysis, 6th Ed., Pearson Education India (2009).

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INORGANIC CHEMISTRY II - S & P-BLOCK ELEMENTS

The Semester question paper consists of 2 sections.

PART-A: Consists of EIGHT short answer questions carries 5 marks out of which 5 are to be answered.

PART- B: Consists of FIVE internal choice essay questions. Each question carries 10 marks .

The examiner has to choose 2 question from each Module

The examiner is requested to set question in such a way that the entire syllabus is reflected in the question paper set by him.

The examiner is requested to give equal importance to easy, moderate and difficult questions..

MODULE	5 MARKS QUESTIONS	QUESTION SERIAL NUMBER	10 MARKS QUESTIONS	QUESTION SERIAL NUMBER	TOTAL MARKS
1	2	1,2	1 (1 OUT OF 2INTERNAL CHOICE)	9	20
2	1	3	1 (1 OUT OF 2 INTERNAL CHOICE)	10	15
3	2	4,5	1 (1 OUT OF 2 INTERNAL CHOICE)	11	20
4	1	6	1 (1 OUT OF 2 INTERNAL CHOICE)	12	15
5	2	7, 8	1 (1 OUT OF 2 INTERNAL CHOICE)	13	20

Weightage for each level of Bloom's Taxonomy		
Bloom's Taxonomy level	Type of question	Weightage
Knowledge /Remember	(Define/ list/state) type.	15 marks
Comprehension/ Understand	(Classify, describe, discuss, identify, explain, report) type	30 marks
Application	(Solve, Sketch, interpret) type. Sums& Mechanisms	20 marks
Analysis	(Differentiate, distinguish, Compare) type.	15 marks
Evaluation	Argue, Defend, judge,	10marks
Create	Derive, Design, construct, Develop, formulate, investigate	

MODEL PAPER B.Sc., DEGREE EXAMINATION PAPER-V SEMESTER-III

CHE(H)-CC-V INORGANIC CHEMISTRY II-S & P-BLOCK ELEMENTS

Time: 3 hours Maximum Marks: 75

PART-A

Answer any FIVE of the following questions. Each carries FIVE marks 5 X 5 = 25 Marks

1. Explain the parting process.
2. What is electrolytic reduction, and explain with an example.
3. Why some 6th period p block elements differ with their remaining group elements in their stable oxidation states.
4. Discuss diagonal relationship with suitable examples.
5. How do you prepare silanes? How stable the are?
6. Write short note on inter halogen compounds.
7. what are clathrates? Compare with other compounds.
8. Define phosphazenes and explain their structure.

PART-B

Answer ALL the questions. Each carries TEN marks 5X 10 = 50 Marks

9 (a).Explain the Ellingham diagrams for reduction of metal oxides using carbon and carbon monoxide as reducing agent.

(Or)

(b) Relative stability of different oxidation states (S-block elements) (ii) Allotropy and catenation

10.a). Explain the (i) Brönsted-Lowry concept of acid-bases (ii) Lewis acid-base concept

(Or)

(b) Explain HSAB principle.

11.(a). b). Define hydrides. Write their classification.

(or)

(b) Explain oxides and oxoacids of nitrogen.

12.(a). Write the preparation and properties of XeF_4& XeF_6

Or

(b) explain the extraction of noble gases by liquefaction of air.

13. (a) Discuss the preparation, properties of silicones.

Or

(b) Explain the synthesis and structural aspects of borazine and boran nitride.

SEMESTER III

Che(H)-CC-VI: Organic Chemistry II - Oxygen Containing Functional Groups

(w.e.f. Academic Year 2022-2023)

Credits 4 **60 hrs (4 h / w)**

Learning objective:

On completion of this course, the students will be able to understand:

1. Mechanism of SN^1, SN^2 and SN^i, SNAr, Benzyne mechanism.
2. Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution
3. Relative reactivity of 1°, 2°, 3° alcohols;
4. Mechanism of Pinacol-Pinacolone rearrangement;
5. Acidity of phenols and alcohols
6. Mechanisms of named reactions like Reimer–Tiemann and Kolbe's–Schmidt Reactions.
7. Structure, reactivity and preparation of carbonyl compounds
8. Mechanisms of Aldol and Benzoin condensation, Cannizzaro and Wittig reaction, Beckmann rearrangements, haloform reaction and Baeyer Villiger oxidation.
9. Preparation, physical properties and reactions of monocarboxylic acids:
10. Preparation and reactions of acid chlorides, anhydrides, esters and amides

Course Outcomes:

After completion of the course students are able to learn about:

1.Differences of SN1, SN2 and SNi mechanisms with stereochemical aspects a
2.effect of solven on Nucleophilic Substitution Raections
3. SNAr, Benzyne mechanism.
4.Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides
5.relative reactivity of 1°, 2°, 3° alcohols
6. Reimer–Tiemann and Kolbe's–Schmidt Reactions, with mechanism.
7.Mechanisms of Aldol and Benzoin condensation, Cannizzaro and Wittig reaction, Beckmann rearrangements, haloform reaction and Baeyer Villiger oxidation.
8.Active methylene compounds: Keto-enol tautomerism.
9. Claisen condensation, Dieckmann and Reformatsky reactions.

Organic Chemistry II - Oxygen Containing Functional Groups Syllabus (60h):

MODULE I: Chemistry of Halogenated Hydrocarbons: 15h

Alkyl halides: Methods of preparation, nucleophilic substitution reactions – SN1, SN2 and SNi mechanisms with stereochemical aspects and effect of solvent;

Aryl halides: Preparation, including preparation from diazonium salts. nucleophilic aromatic substitution; SNAr, Benzyne mechanism.

Relative reactivity of alkyl, allyl/benzyl, vinyl and aryl halides towards nucleophilic substitution reactions.

MODULE II: Alcohols, Phenols, Ethers and Epoxides:

10h

Alcohols: preparation, properties and relative reactivity of 1°, 2°, 3° alcohols, Oxidation by periodic acid and lead tetraacetate, Pinacol-Pinacolone rearrangement;

Phenols: Preparation and properties; Acidity and factors effecting it, Ring substitution reactions, Reimer–Tiemann and Kolbe's–Schmidt Reactions, with mechanism.

MODULE III: Carbonyl Compounds:

15h

Structure, reactivity and preparation; Nucleophilic additions, Nucleophilic addition-elimination reactions with ammonia derivatives with mechanism; Mechanisms of Aldol and Benzoin condensation, Cannizzaro and Wittig reaction, Beckmann rearrangements, haloform reaction and Baeyer Villiger oxidation.

Addition reactions of unsaturated carbonyl compounds: Michael addition. Active methylene compounds: Keto-enol tautomerism.

MODULE-IV: Carboxylic Acids

10h

Preparation, physical properties and reactions of monocarboxylic acids: Typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids: succinic, lactic, malic, tartaric, citric, maleic and fumaric acids;

MODULE V: Carboxylic Acids Derivatives

10h

Preparation and reactions of acid chlorides, anhydrides, esters and amides; -Mechanism of acidic and alkaline hydrolysis of esters, Claisen condensation, Dieckmann and Reformatsky reactions.

Reference Books:

1.Morrison, R. T. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

2.Finar, I. L. *Organic Chemistry* (*Volume 1*), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).

3.McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition 2013.

CC-VI: ORGANIC CHEMISTRY -II LAB (CC/PPC)

Hours per week: 3 Credits: 1 Continuous Evaluation: 50 marks

1. Functional group tests for alcohols, phenols, carbonyl and carboxylic acid group.
2. Organic preparations:

i. Acetylation of one of the following compounds: amines (aniline, *o*-, *m*-, *p*-toluidines and *o*-, *m*-, *p*-anisidine) and phenols (β-naphthol, vanillin, salicylic acid) by any one method:

a. Using conventional method.

b. Using green approach

ii. Benzolyation of one of the following amines (aniline, *o*-, *m*-, *p*- toluidines and *o*-, *m*-, *p*-anisidine) and one of the following phenols (β-naphthol, resorcinol, p-cresol) by Schotten-Baumann reaction.

iii. Bromination of any one of the following:

a. Acetanilide by conventional methods

b. Acetanilide using green approach (Bromate-bromide method)

iv. Nitration of any one of the following:

a. Acetanilide/nitrobenzene by conventional method

b. Salicylic acid by green approach (using ceric ammonium nitrate).

The above derivatives should be prepared using 0.5-1g of the organic compound. The solid samples must be collected and may be used for recrystallization, melting point and TLC.

Reference Books

1. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry,* Pearson Education (2009)

2. Ahluwalia, V.K. & Aggarwal, R. *Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis,* University Press (2000).

3. Ahluwalia, V.K. & Dhingra, S. *Comprehensive Practical Organic Chemistry: Qualitative Analysis,* University Press (2000).

BLUE PRINT

Important Tips for Setting Question Paper

- ✔ The examiner is requested to set question in such a way that the entire syllabus is reflected in the question paper set by him.
- ✔ It is suggested that the question writer should use his/her judgment in assigning difficulty value to each question. Following scale should guide you to set questions at different difficulty levels and use the **Bloom's Taxonomy** action verbs given below.

Bloom's Level	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating
% of Weightage	30	20	20	15	10	5

Question Paper Pattern

- ✔ The Semester question paper consists of 2 sections.
  PART-A: Consists of **EIGHT** short answer questions carries **5** marks out of which **5** are to be answered.
  PART- B: Consists of **FIVE** internal choice essay questions. Each question carries **10** marks.
- ✔ The examiner has to choose **2** questions from each module.

Sl. No	Modules	Name of the Module	5 M Questions	Question Serial Number	10 M Questions	Question Serial Number	Weightage per Module
1	1	**Chemistry of Halogenated Hydrocarbons**	2	1, 2	2	9 (a) or 9 (b)	20 Marks
2	2	**Alcohols, Phenols, Ethers and Epoxides**	2	3,4	2	10 (a) or 10 (b)	20 Marks
3	3	**Carbonyl Compounds**	2	5,6	2	11 (a) or 11 (b)	20 Marks
4	4	**Carboxylic Acids**	1	7	2	12 (a) or 12 (b)	15 Marks
5	5	**Carboxylic Acids Derivatives**	1	8	2	13 (a) or 13 (b)	15 Marks

MODEL PAPER

Dr. V. S Krishna Govt. Degree College, Visakhapatnam (A)

II B.Sc. Chemistry DEGREE SECOND YEAR EXAMINATIONS

Paper –VI (CC-VI), SEMESTER- III

(Organic Chemistry II - Oxygen Containing Functional Groups)

Time: 3 hours **Maximum Marks: 75Marks**

PART- A

I. Answer any **FIVE** of the following questions **5x5 = 25Marks**

1. Write about nucleophilic aromatic substitution.
2. Explain Benzyne mechanism.
3. Explain Pinacol-Pinacolone rearrangement.
4. Explain acidity of Phenol.
5. Explain Michael addition reaction with mechanism
6. Explain Keto-enol tautomerism in active methylene compounds.
7. Explain typical reactions of unsaturated acids.
8. Explain Claisen condensation with mechanism.

PART- B

II.Answer **ALL** the questions 5x10 = 50 Marks

9. (a). Explain mechanisms of SN1, SN2 with stereochemical aspects and effect of solvent.

(OR)

(b).Explain relative reactivity of alkyl, allyl, benzyl, vinyl and aryl halides towards nucleophilic substitution.

10. (a). Explain preparation and properties of Alcohols.

(OR)

(b).Explain Reimer–Tiemann and Kolbe's–Schmidt Reactions with mechanism.

11. (a). Explain Mechanisms of Aldol and Cannizzaro reactions.

(OR)

(b).Explain Mechanisms of Wittig reaction and Beckmann rearrangements

12. (a). Explain Preparation, physical properties and reactions of monocarboxylic acids.

(OR)

(b).Explain Typical reactions of dicarboxylic acids and hydroxy acids

13. (a). Explain preparation and reactions of acid chlorides and anhydrides.

(OR)

(b).Explain mechanism of acidic and alkaline hydrolysis of esters

CC 7: ORGANIC CHEMISTRY III – HETEROCYCLIC CHEMISTRY (CC)

Hours per week: 4 Semester End Examination: 60 Marks

Credits: 4 Continuous Evaluation: 40 marks

Course outcomes:

After completion of the course students are able to understand:

CO1. Gabriel phthalimide synthesis, Carbylamine reaction, Mannich reaction,

CO2. Structure, Preparation and structural elucidation of important derivatives of naphthalene and anthracene

CO3. Medicinal importance of Nicotine, Hygrine.

CO4. The structure and synthesis of Hygrine and Nicotine.

CO5. The synthesis of pyrrole, furan,thiophene, pyridine.

CO6. The reactivity of pyrrole, furan, thiophene and pyridine

MODULE I: Nitrogen Containing Functional Groups

Preparation and important reactions of nitro and compounds, nitriles and isonitriles. Tautomerism in nitro alkanes.

Amines: Effect of substituent and solvent on basicity; Preparation and properties: Gabriel phthalimide synthesis, Carbylamine reaction, Mannich reaction, , Hofmann-elimination reaction; Distinction between 1°, 2° and 3° amines with Hinsberg reagent and nitrous acid.

Diazonium Salts: Preparation and their synthetic applications.

MODULE II: Polynuclear Hydrocarbons

Structure, Preparation and structure elucidation and important derivatives of naphthalene and anthracene; Reactions of naphthalene, phenanthrene and anthracene Polynuclear hydrocarbons.

MODULE III: Heterocyclic Compounds

Classification and nomenclature, Structure, aromaticity in 5-numbered and 6-membered rings containing one heteroatom; Synthesis, reactions and mechanism of substitution reactions of: Furan, Pyrrole (Paal-Knorr synthesis, Knorr pyrrole synthesis, Hantzsch synthesis), Thiophene, Pyridine (Hantzsch synthesis), Nucleophilic substitution in pyridine, Chichibabin reaction.

MODULE IV: Alkaloids

Natural occurrence, General structural features, Isolation. Hoffmann's exhaustive methylation, Emde's modification, Structure elucidation and synthesis of Hygrine and Nicotine. Medicinal importance of Nicotine, Hygrine, Identification tests for alkaloids

MODULE V: Terpenes

Occurrence, classification of terpenes, isoprene rule; Elucidation of stucture and synthesis of Citral and α-terpineol,

Reference Books:

1. Morrison, R. T. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Finar, I. L. *Organic Chemistry* (*Volume 1*), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
3. Finar, I. L. *Organic Chemistry* (*Volume 2: Stereochemistry and the Chemistry of Natural Products*), Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
4. McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
5. Kalsi, P. S. *Textbook of Organic Chemistry 1st Ed.*, New Age International (P) Ltd. Pub.
6. Singh, J.; Ali, S.M. & Singh, J. *Natural Product Chemistry*, Prajati Parakashan (2010)

7 ORGANIC CHEMISTRY III LAB

Hours per week: 3 Credits: 2 Continuous Evaluation: 100 marks

Detection of extra elements.

1. Functional group test for nitro, amine, hydroxy and amide groups.
2. Qualitative analysis of unknown organic compounds containing simple functional groups (alcohols, carboxylic acids, phenols and carbonyl compounds)

Reference Books

1. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry*, Pearson Education (2009)
2. Furniss, B.S.; Hannaford, A.J.; Smith, P.W.G.; Tatchell, A.R. *Practical Organic Chemistry, 5th Ed.*, Pearson (2012)
3. Ahluwalia, V.K. & Aggarwal, R. *Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis*, University Press (2000).
4. Ahluwalia, V.K. & Dhingra, S. *Comprehensive Practical Organic Chemistry: Qualitative Analysis*, University Press (2000).

BLUE PRINT FOR QUESTION PAPER SETTER

TIME: 3 Hrs Max.Marks:75

S.No.	MODULE NO. /CHAPTER NO.		SHORT ANSWER QUESTIONS (5 Marks)	ESSAY QUESTIONS (10 Marks)	MARKS ALLOETD TO THE MODULE
1	MODULE-I	1.Nitrogen containing functional groups	2	2	30
2	MODULE-II	2. Polynuclear hydrocarbons	1	2	25

3	**MODULE-III**	3. Heterocyclic compounds	2	2	30
4	**MODULE-IV**	4. Alkaloids	2	2	30
5	**MODULE-V**	5. Terpenes	1	2	25
	Total no. of Questions		8	10	
	Total Marks including Choice				140

Note: **Important Tips for Setting Question Paper**

- ✔ The examiner is requested to set question in such a way that the entire syllabus is reflected in the question paper set by him/her.
- ✔ It is suggested that the question writer should use his/her judgment in assigning difficulty value to each question. Following scale should guide you to set questions at different difficulty levels and use the **Bloom's Taxonomy**action verbs given below.

Bloom's Level	**Remembering**	**Understanding**	**Applying**	**Analyzing**	**Evaluating**	**Creating**
% of Weightage	30	20	20	15	10	5

Question Paper Pattern

- ✔ The Semester question paper consists of 2 sections.

PART-A: Consists of **EIGHT** short answer questions carries **5** marks out of which **5** are to be answered.

PART- B: Consists of **FIVE** internal choice essay questions. Each question carries **10** marks.

MODEL PAPER-1

Dr. V. S Krishna Govt. Degree College, Visakhapatnam (A)

II B.Sc. Chemistry DEGREE SECOND YEAR EXAMINATIONS

Paper –VII (CC-VII), SEMESTER- IV

CHE (H)-CC-VII ORGANIC CHEMISTRY III - HETEROCYCLIC CHEMISTRY

Maximum Marks: 75 Time: 3 hours

PART-A

5X5-25 Marks

Answer any FIVE of the following questions. Each carries FIVE marks

1. Explain the basicity of amines
2. Explain the preparation and reactions of nitro compounds
3. Write the structure of phenanthrene.
4. Explain the classification and nomenclature of hetero cyclic compounds

5. Explain aromaticity of thiophene and furan.
6. Explain classification of alkaloids.
7. Explain the Hoffmann's exhaustive methylation.
8. Explain isoprene rule.

PART-B

5X 10=50 Marks

Answer ALL the questions.
Each carries TEN marks

9 (a). Explain the preparation and properties of of Amines.

(or)

(b) Explain the preparation and synthetic applications of Diazonium salts

10 (a) Explain the Preparation and any three properties of napthalene..

(or)

(b). Explain the Preparation and structure elucidation of anthracene

11.(a) Explain the synthesis and reactions of pyrrole

(or)

(b) Explain the synthesis and reactions of pyridine

12 (a) Explain the Structure elucidation of Hygrine

(or)

(b). Write the synthesis of Nicotine

13. (a) Explain Structure elucidation and synthesis of citral

(or)

(b) Explain Structure elucidation and synthesis of a-terpineol.

PHYSICAL CHEMISTRY III - PHASE EQUILIBRIA AND CHEMICAL KINETICS (CC-8)

Hours per week: 4 — Semester End Examination: 60 Marks
Credits: 4 — Continuous Evaluation: 40 marks

Course outcomes:

After completion of the course students are able to learn about:

CO1. Phase diagrams for systems of solid-liquid equilibria involving eutectic, congruent and incongruent melting points.
CO2. Methods of Experimental determination of rate laws.
CO3. Collision theory of reaction rates
CO4. Langmuir and Freundlich isotherms.
CO5. The cleansing action of detergents.
CO6: Emulsions and their classification
CO7: Freezing mixtures and their industrial importance
CO8: Concept of nanocatalysis and applications in industry.

MODULE-I: Phase Equilibria-1

Concept of phases, components and degrees of freedom, derivation of Gibbs Phase Rule for nonreactive and reactive systems; Clausius-Clapeyron equation and its applications to solid-liquid, liquid-vapour and solid-vapour equilibria, phase diagram for one component systems, with applications.

Phase diagrams for systems of solid-liquid equilibria involving eutectic, congruent and incongruent melting points. Freezing mixtures

MODULE-II: Phase equilibria-2

Three component systems, water-chloroform-acetic acid system.

Binary solutions: Gibbs-Duhem-Margules equation, its derivation and applications to fractional distillation of binary miscible liquids (ideal and non ideal), partial miscibility of liquids, CST, steam distillation. Nernst distribution law: its derivation and applications.

MODULE-III: Chemical Kinetics

Order and molecularity of a reaction, rate laws in terms of the advancement of a reaction, differential and integrated form of rate expressions up to second order reactions, experimental methods of the determination of rate laws.

Temperature dependence of reaction rates; Arrhenius equation; activation energy. Collision theory of reaction rates, qualitative treatment of the theory of absolute reaction rates. Activated complex theory-non mathematical treatment.

MODULE-IV: Catalysis:

Definition of catalyst, types of catalysts - Homogeneous and heterogeneous catalysis - acid-base catalysis- Autocatalysis nanocatalysis – prototropic and protolytic mechanism and derivation of rate law, Enzyme catalysis, Michaelis-Menten kinetics.

MODULE-V: Surface chemistry:

Physical adsorption, chemisorption, Factors influencing adsorption-adsorption isotherms – types-Langmuir and Freundlich isotherms. Surface active agents- classification- emusions-types-critical micellar concentration (CMC) - factors affecting the CMC of surfactants- determination of cmc. Solubilisation-factors influencing the solubilization. Explanation of cleansing action of detergents.

Reference Books:

1. Peter Atkins & Julio De Paula, *Physical Chemistry* 10th Ed., Oxford University Press (2014).
2. Mortimer, R. G. *Physical Chemistry 3rd Ed.*, Elsevier: NOIDA, UP (2009).
3. Levine, I. N. *Physical Chemistry 6th Ed.*, Tata McGraw-Hill (2011).

8 PHYSICAL CHEMISTRY III LAB (PPC)

Hours per week: 3 Credits: 2 Continuous Evaluation: 100 marks

I. Determination of critical solution temperature and composition of the phenol-water system and to study the effect of impurities on it.

II. Phase equilibria: Construction of the phase diagram using cooling curves or ignition tube method:
   a. simple eutectic and
   b. congruently melting systems.

III. Distribution of acetic/ benzoic acid between water and cyclohexane.

IV. Study the equilibrium of at least one of the following reactions by the distribution method:
   (i) $I_2(aq) + I^- \rightarrow I_3^-(aq)^{2+}$
   (ii) $Cu^{2+}(aq) + nNH_3 \rightarrow Cu(NH_3)_n$

V. Study the kinetics of the following reactions.
   1. Integrated rate method:
      Acid hydrolysis of methyl acetate with hydrochloric acid.
   2. Compare the strengths of HCl and H2SO4 by studying kinetics of hydrolysis of methyl acetate.

VI. Adsorption

I. Verify the Freundlich and Langmuir isotherms for adsorption of acetic acid on activated charcoal.

Reference Books:

1. Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry,* R. Chand & Co.: New Delhi (2011).
2. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. *Experiments in Physical Chemistry 8th Ed.*; McGraw-Hill: New York (2003).
3. Halpern, A. M. & McBane, G. C. *Experimental Physical Chemistry 3rd Ed.;* W.H. Freeman & Co.: New York (2003).

BLUE PRINT FOR QUESTION PAPER SETTER

TIME: 3 Hrs Max.Marks:75

S.No.	MODULE NO. /CHAPTER NO.		SHORT ANSWER QUESTIONS (5 Marks)	ESSAY QUESTIONS (10 Marks)	MARKS ALLOETD TO THE MODULE
1	1	1. Phase equilibria-1	2	2	30
2	2	2. Phase equilibria-2	1	2	25
3	3	3. Chemical Kinetics	2	2	30
4	4	4. Catalysis	1	2	25
5	5	5. Surface Chemistry	2	2	30
	Total no. of Questions		8	10	
	Total Marks including Choice				140

Note:

1.The question paper setters are requested to kindly adhere to the format given in the above table.

2.The question paper setters are also requested to set the questions in the following way:

a. 70 % of Questions - Memory (knowledge) and Understanding based

b. 30 % of Questions - Creativity, Application and Skill based

MODEL PAPER-1

B.Sc, DEGREE EXAMINATION

SEMESTER-IV.PAPER-VIII CHE(H)-CC-VIII PHYSICAL CHEMISTRY III-PHASE EQUILIBRIA AND CHEMICAL KINETICS

Time 3 hours Maximum Marks. 75

PART-A 5X5-25 Marks

Answer any FIVE of the following questions each carries FIVE marks

1 Explain phase diagram of one component system

2. Derive Clausius-Clapeyron equation.

3. Write Nernst distribution law and any two its applications 4 Derive second order rate reaction

5 Explain the order and molecurity with examples.

6. Explain acid base catalysis

7. Writ short notes on emulsions.

8. Explain Freundlich isotherms

PART-B 5X 10=50 Marks

Answer ALL the questions. Each carries TEN marks

9 (a)Define phase rule?Explain the terms in phase rule

(or)

(b) Explain Phase diagrams for one component systems

10 (a) Explain the water-chloroform-acetic acid system

(or)

(b). Explain fractional distillation of binary miscible liquids

11. (a) Explain the experimental methods of the determination of rate law

(or)

(b) Explain Collision theory of reaction rates

12 (a) Define catalyst? Explain types of catalysis with examples

(or)

(b)Derive Michaelis-Menton equation

13 (a). Explain Langmuir adsorption isotherms

(or)

(b) Define critical micellar concentration ? Explain factors affecting the CMC of Surfactants

SEMESTER-IV

CHE(H)-CC-IX INORGANIC CHEMISTRY III - COORDINATION CHEMISTRY AND GREEN CHEMISTRY

Learning objective:

On completion of this course, the students will be able to understand:

LO1. Catalytic properties, ability to form complexes of transition elements.

LO2. Spectral and magnetic properties of inner transition elements.

LO3. Werner's theory, valence bond theory of coordination complex compounds.

LO4. Twelve principles of green chemistry

Course Outcomes:

After completion of the course students are able to learn about:

CO1. Chemistry of Ti, V, Cr Mn, Fe and Co in various oxidation states.

CO2. CFT of Octahedral, tetrahedral complexes and Jahn-Teller theorem,

CO3. Iron and its application in bio-systems.

CO4. The use of ultrasound in organic synthesis.

CO5. The advantage of Microwave assisted reactions.

CO6. The Excess and deficiency of some trace metals and Toxicity of metal ions.

CHE(H)-CC-IX INORGANIC CHEMISTRY III - COORDINATION CHEMISTRY AND GREEN CHEMISTRY(60H)

SYLLABUS

MODULE-I: Transition Elements:

12H

General group trends with special reference to electronic configuration, colour, variable valency, magnetic and catalytic properties, ability to form complexes.

Chemistry of Ti, V, Cr Mn, Fe and Co in various oxidation states (excluding their metallurgy)

Lanthanoids and Actinoids:

Electronic configuration, oxidation states, colour, spectral and magnetic properties, lanthanide contraction, separation of lanthanides (ion-exchange method only).

MODULE-II: Coordination Chemistry

15H

IUPAC nomenclature of coordination compounds, isomerism in coordination compounds. Stereochemistry of complexes with 4 and 6 coordination numbers. Chelate effect, polynuclear complexes, Labile and inert complexes.Werner's theory, valence bond theory (inner and outer orbital complexes), electroneutrality principle and back bonding. Crystal field theory, measurement of 10 Dq (o), CFSE in weak and strong fields, pairing energies, factors affecting the magnitude of 10 Dq (o, t). Octahedral vs. tetrahedral coordination, tetragonal distortions from octahedral geometry Jahn-Teller theorem,

MODULE-III: Bioinorganic Chemistry **8H**

Metal ions present in biological systems, Geochemical effect on the distribution of metals. Sodium / K-pump, carbonic anhydrase and carboxypeptidase. 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. Iron and its application in bio-systems, Haemoglobin; Storage and transfer of iron.

MODULE-IV: Introduction to Green Chemistry **15H**

Green chemistry - Introduction - need for green chemistry - goals of green chemistry - Anastas' twelve principles of green chemistry - Designing a green synthesis (tools) - choice of starting materials, solvents, catalysts, reagents, processes with suitable examples.

Microwave and Ultrasound Assisted Reactions

Microwave activation - advantages of microwave exposure - Microwave assisted reactions, condensation reactions - oxidation, reduction reactions, multicomponent reactions.

Sonochemistry - use of ultrasound in organic synthesis (alternate source of energy) - saponification - substitution, addition, oxidation reactions, reductions.

MODULE-V: Green Analytical Techniques **10H**

Micelle mediated extraction- Cloud point extraction and adsorptive miceller flocculation methods. Solid Phase Micro Extraction (SPME)

Future Trends in Green Chemistry

Oxidation reagents and catalysts; Biomimetic, multifunctional reagents; Combinatorial green chemistry; Proliferation of solventless reactions; co crystal controlled solid state synthesis (C2S3); Green chemistry in sustainable development.

Reference Books:

1. Huheey, J.E., *Inorganic Chemistry*, Prentice Hall, 1993.
2. Basolo, F, and Pearson, R.C. *Mechanisms of Inorganic Chemistry*, John Wiley & Sons, NY, 1967.
3. Greenwood, N.N. & Earnshaw A. *Chemistry of the Elements*, Butterworth-Heinemann, 1997.
4. Paul T. Anastas and John C. Warner, "Green Chemistry", Oxford University Press, Indian Edition, 2008.
5. V. K. Ahluwalia and M. Kidwai, "New Trends in Chemistry", Anamaya Publishers, 2nd Edition, 2007.
6. V. Kumar, "An Introduction to Green Chemistry", Vishal Publishers, 1st Edition, 2007.
7. V. K. Ahluwalia and R. S. Varma, "Green Solvents", Narosa Publishing, 1st Edition, 2009.
8. V.K.Ahluwalia and Renu Aggarwal, "Organic Synthetic Special Techniques", Narosa, 2nd Edition, 2009.
9. V. K. Ahluwalia, "Green Chemistry - Environmentally Benign Reactions", Ane books, India, 2006.
10. Matlack, A.S. *Introduction to Green Chemistry*, Marcel Dekker (2001).

CHE(H)-CC-IX INORGANIC CHEMISTRY III - COORDINATION CHEMISTRY AND GREEN CHEMISTRY-LAB

1.Qualitative semimicro analysis of mixtures containing 3 anions and 3 cations. Emphasis should be given on understanding of the chemistry of different reactions. Following radicals may be analyzed:

Carbonate, nitrate, nitrite, sulphide, sulphate, sulphite, acetate, fluoride, chloride, bromide, iodide, borate, oxalate, phosphate, ammonium, potassium, lead, copper, cadmium, bismuth, tin, iron, aluminum, chromium, zinc, manganese, cobalt, nickel, barium strontium, calcium, magnesium. Mixtures containing one interfering anion, or insoluble component ($BaSO_4$, $SrSO_4$, $PbSO_4$, CaF_2 or Al_2O_3) or combination of anions e.g. CO_3^{2-} and SO_3^{2-}, NO_2^- and NO_3^-, Cl^- and Br^-, Cl^- and I^-, Br^- and I^-, NO_3^- and Br^-, NO_3^- and I^-. Spot analysis/tests should be done whenever possible.

2. Synthesis of ammine complexes of Ni(II) and its ligand exchange reactions (e.g. bidentate ligands like acetylacetone, DMG, glycine) by substitution method.

3. Preparation and characterization of nanoparticles of gold using tea leaves.

4.Preparation of biodiesel from vegetable/ waste cooking oil.

References:

1.Anastas, P.T & Warner, J.C. *Green Chemistry: Theory and Practice,* Oxford University Press (1998).

2.Kirchoff, M. & Ryan, M.A. *Greener approaches to undergraduate chemistry experiment.* American Chemical Society, Washington DC (2002).

3.Ryan, M.A. *Introduction to Green Chemistry*, Tinnesand; (Ed), American Chemical Society, Washington DC (2002).

4.Sharma, R.K.; Sidhwani, I.T. and Chaudhari, M.K. I.K. Green Chemistry Experiment: A monograph, International Publishing ISBN 978-93-81141-55-7 (2013).

5.Cann, M.C. and Connelly, M. E. *Real world cases in Green Chemistry*, American Chemical Society (2008).

6.Cann, M. C. and Thomas, P. *Real world cases in Green Chemistry,* American Chemical Society (2008).

7.Lancaster, M. *Green Chemistry: An Introductory Text* RSC Publishing, Second Edition, 2010.

8.Pavia, D. L., Lampman, G.M., Kriz, G.S. & Engel, R.G. *Introduction to Organic Laboratory Techniques: A Microscale and Macro Scale Approach,* W.B.Saunders, 1995.

9. Vogel's *Qualitative Inorganic Analysis,* Revised by G. Svehla. Pearson Education, 2002.

10.Marr & Rockett *Practical Inorganic Chemistry.* John Wiley & Sons 1972.

Guidelines to the Paper Setter:

In PART- A: consists of EIGHT short answer questions carries 5 marks out of which 5 are to be answered..

In PART- B: consists of FIVE internal choice essay questions are to be set, each question carries 10 marks .

The examiner is requested to set question in such a way that the entire syllabus is reflected in the question paper set by him.

B.Sc Chemistry- Semester-IV Paper-IX

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CHE(H)-CC-IX INORGANIC CHEMISTRY III - COORDINATION CHEMISTRY AND GREEN CHEMISTRY

Sl. No	MODULES	Name of the chapter	10 Marks	5 Marks
1.	1.	Transition Elements	2	2
2.	2.	Coordination Chemistry	2	2
3.	3.	Bioinorganic Chemistry	2	1
4.	4.	Introduction to Green chemistry	2	1
5.	5.	Green Analytical Techniques	2	2

MODEL PAPER

B.Sc., DEGREE EXAMINATION

SEMESTER-IV, PAPER-IX

CHE(H)-CC-IX INORGANIC CHEMISTRY III - COORDINATION CHEMISTRY AND GREEN CHEMISTRY

Time: 3 hours Maximum Marks: 75

PART- A 5 X 5 = 25 Marks

Answer any **FIVE** of the following questions. Each carries **FIVE** marks

1.Explain the chemistry of Ti and Fe.

2.Explain lanthanide contraction.

3.Explain Labile and inert complexes with examples.

4.Write the Werner's theory of co ordinate complexes.

5.Explain toxicity of metal ions of Hg and Pb, .

6.Write short notes on green catalysts.

7.Write the advantages of microwave exposure.

8.Explain the green chemistry in sustainable development.

PART- B 5X 10 = 50 Marks

Answer **ALL** the questions. Each carries **TEN** marks

9 (a) Explain the electronic configuration,and magnetic properties of transition elements.

(or)

(b) Explain the oxidation staes and spectral properties of lanthnoids.

(or)

10 (a) Explain the Crystal field splitting of octahedral complexes.

(or)

(b). (i) Explain the isomerism in coordination compounds.

(ii) Explain the Chelate effect

11.(a). Explain carbonic anhydrase and carboxypeptidase..

(or)

(b) Explain the structure of Haemoglobin.

12 (a) Define green chemistry? Explain the twelve principles of green chemistry.

(or)

(b)Explain the reactions of substitution, addition, oxidation by using Sonochemistry.

13.(a). Explain Green Analytical Techniques.

(or)

(b). Explain the following.

(i) multifunctional reagents (ii) Oxidation reagents and catalysts

DEPARTMENT OF CHEMISTRY

DR. V. S KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM

SYLLABUS FOR B. Sc. Chemistry SEMESTER – IV, CC- X

PHYSICAL CHEMISTRY V- QUANTUM CHEMISTRY & SPECTROSCOPY

(w.e.f. Academic Year 2022-2023)

Credits: 4 **Teaching Hours: 60 Hours (4h / W)**

Learning objective:

1. Understand the basis of quantum mechanics, the role of quantum mechanics in chemistry, learn about the origin of quantum, operators in quantum mechanics, writing rule in quantum chemistry and learn properties of operators. Identify the steps involved in solving a model of particle in a box
2. Identify the steps involved in solving a model of particle in a box
3. Write and solve the Schrodinger equation for Rigid Rotator.
4. Know the basic model for vibration motion of diatomic molecules and solve the Schrodinger equation for simple harmonic oscillator.
5. Write and solve the Schrodinger equation for Hydrogen atom.
6. Write Schrödinger equation for complex systems using the variation method. Solve Schrödinger equation for Helium atom using variation method.
7. Learn electromagnetic radiation with molecules and various types of spectra.
8. Understand the basic fundamental and application knowledge in Rotational, Vibrational and Raman spectroscopy.
9. Understand electronic transitions of diatomic molecules. Use the Franck-Condon principle to predict the shape of the absorption curve.
10. Understand the basic principle of NMR spectroscopy, the nuclear properties, Interaction between spin and a magnetic field, Larmor precession and splitting of energy levels in a magnetic field.
11. Know the light and matter interaction, photo process, quantum yield and its measurements.

Course Outcomes:

After completion of the course students are able to:

CO1. Explain the concepts of postulates of quantum mechanics, operators and Schrödinger equation

CO2: Explain and solve the Schrodinger equation for Rigid Rotator.

CO3: Describe the steps involved in solving a model of particle in a box.

CO4. Describe Schrödinger equation for complex systems using Variation Method and solve Schrödinger equation for He atom using variation method.

CO5. Explain the rotational energy levels in diatomic molecules and isotopic substitution in rotational molecules

CO6. Explain the different functional groups such as acid, aldehyde, ketone, alkanes, nitriles, alcohols and amines through the IR-spectroscopy.

CO7. Describe the principal of NMR, spin-spin splitting and coupling constant.

CO8. Describe the principal of ESR, Hyper-fine splitting and its application to methyl radical.

CO9. Explain the radiative and non-radiative transitions in photochemistry

CO10. Explain the quantum yield and actinometric methods.

SEMESTER-IV- CHE(H)-CC-X PHYSICAL CHEMISTRY V- QUANTUM CHEMISTRY & SPECTROSCOPY

Module-I: Quantum Chemistry-1 **15H**

Postulates of quantum mechanics, quantum mechanical operators, Schrödinger equation and its application to free particle and particle in a one-dimensional box (rigorous treatment) extension to two- and three-dimensional boxes with respect to degeneracy, quantization of energy levels, zero-point energy and Heisenberg Uncertainty principle;

Qualitative treatment of simple harmonic oscillator model of vibrational motion: Setting up of Schrödinger equation. Vibrational energy of diatomic molecules, rigid rotator model of rotation of diatomic molecule and zero-point energy.

Module-II: Quantum Chemistry-2 **10 H**

Qualitative treatment of hydrogen atom; setting up of Schrödinger equation in spherical polar coordinates.

Setting up of Schrödinger equation for many-electron atoms (He). Need for approximation methods. Statement of variation theorem and application to simple systems (harmonic oscillator).

Chemical bonding: Covalent bonding, valence bond and molecular orbital approaches, LCAO-MO treatment of H_2^+. Bonding and Anti-Bonding Orbitals, Qualitative extension to H_2. Comparison of LCAO-MO and VB treatments of H_2 (only wavefunctions, detailed solution not required).

Module-III: Molecular Spectroscopy-1 **15H**

Interaction of electromagnetic radiation with molecules and various types of spectra.

Rotation spectroscopy: Selection rules, intensities of spectral lines, determination of bond lengths of diatomic and linear triatomic molecules, isotopic substitution.

Vibrational spectroscopy: Classical equation of vibration, computation of force constant, amplitude of diatomic molecular vibrations, anharmonicity, fundamental frequencies, overtones, hot bands.

Raman spectroscopy: Qualitative treatment of Rotational Raman effect; Effect of nuclear spin, Vibrational Raman spectra, Stokes and anti-Stokes lines; their intensity difference, rule of mutual exclusion.

Module-IV: Molecular Spectroscopy-2 **10H**

Electronic spectroscopy: Franck-Condon principle, electronic transitions, singlet and triplet states, fluorescence and phosphorescence. Calculations of electronic transitions in polyenes using free electron model.

Nuclear Magnetic Resonance (NMR) spectroscopy: Principles of NMR spectroscopy, chemical shift, different scales, spin-spin coupling and interpretation of PMR spectra of organic molecules.

Electron Spin Resonance (ESR) spectroscopy: Its principle, hyperfine structure, ESR of simple radicals.

Module-V: Photochemistry **10 H**

Characteristics of electromagnetic radiation, Photo process, Lambert-Beer's law and its limitations, physical significance of absorption coefficients. Laws of photochemistry, quantum yield, actinometry, examples of low and high quantum yields, photochemical equilibrium photosensitized reactions, quenching. Role of photochemical reactions in biochemical processes.

CHE(H)-CC-10 – PHYSICAL CHEMISTRY-V LAB (30 Hours)

Hours per week: 2 **Evaluation: 50 marks** **Credits: 1**

(A) UV/Visible spectroscopy

I. Study the 200-500 nm absorbance spectra of $KMnO_4$ and $K_2Cr_2O_7$ (in 0.1 M H_2SO_4) and determine the λmax values. Calculate the energies of the two transitions in different MODULEs (J molecule^{-1}, kJ mol^{-1}, cm^{-1}, eV).

II Study the pH-dependence of the UV-Vis spectrum (200-500 nm) of $K_2Cr_2O_7$.

(B) Colorimetry

I. Verify Lambert-Beer's law and determine the concentration of $CuSO_4$/$KMnO_4$/$K_2Cr_2O_7$ in a solution of unknown concentration

II. Determine the concentrations of $KMnO_4$ and $K_2Cr_2O_7$ in a mixture.

III Determine the amount of iron present in a sample using 1,10-phenathroline.

IV Determine the dissociation constant of an indicator (phenolphthalein)

Reference Books:

Theory:

1. Banwell, C. N. & McCash, E. M. *Fundamentals of Molecular Spectroscopy* 4th Ed. Tata McGraw-Hill: New Delhi (2006).
2. Chandra, A. K. *Introductory Quantum Chemistry* Tata McGraw-Hill (2001).
3. House, J. E. *Fundamentals of Quantum Chemistry* 2nd Ed. Elsevier: USA (2004).
4. Kakkar, R. *Atomic & Molecular Spectroscopy: Concepts & Applications*, Cambridge University Press (2015).
5. Lowe, J. P. & Peterson, K. *Quantum Chemistry*, Academic Press (2005).

Practical:

1. Khosla, B. D.; Garg, V. C. & Gulati, A., *Senior Practical Physical Chemistry*, R. Chand & Co.: New Delhi (2011).
2. Garland, C. W.; Nibler, J. W. & Shoemaker, D. P. *Experiments in Physical Chemistry 8th Ed.;* McGraw-Hill: New York (2003).
3. Halpern, A. M. & McBane, G. C. *Experimental Physical Chemistry 3rd Ed.;* W.H. Freeman & Co.: New York (2003).

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PHYSICAL CHEMISTRY V - QUANTUM CHEMISTRY & SPECTROSCOPY

The Semester question paper consists of 2 sections.

PART-A: Consists of EIGHT short answer questions carries 5 marks out of which 5 are to be answered.

PART- B: Consists of FIVE internal choice essay questions. Each question carries 10 marks. The examiner has to choose 2 questions from each Module

The examiner is requested to set question in such a way that the entire syllabus is reflected in the question paper set by him.

The examiner is requested to give equal importance to easy, moderate and difficult questions.

MODULE	5 MARKS QUESTIONS	QUESTION SERIAL NUMBER	10 MARKS QUESTIONS	QUESTION SERIAL NUMBER	TOTAL MARKS
1	2	-1,2	1 (1 OUT OF 2 INTERNAL CHOICE)	9	20
2	1	3	1 (1 OUT OF 2 INTERNAL CHOICE)	10	15
3	2	4 5	1 (1 OUT OF 2 INTERNAL CHOICE)	11	20
4	1	6	1 (1 OUT OF 2 INTERNAL CHOICE)	12	15
5	2	7,8	1 (1 OUT OF 2 INTERNAL CHOICE)	13	20

Weightage for each level of Bloom's Taxonomy

Bloom's Taxonomy level	Type of question	Weightage
Knowledge /Remember	(Define/ list /state) type.	15 marks
Comprehension	(Classify, describe, discuss, identify, explain, report) type	30 marks
Application	(Solve, Sketch, interpret) type. Sums & Mechanisms	20 marks
Analysis	(Differentiate, distinguish, Compare) type.	15 marks
Evaluation	Argue, Defend, judge,	10marks
Create	Derive, Design, construct, Develop, formulate, investigate	

MODEL PAPER B.Sc., DEGREE EXAMINATION PAPER-V SEMESTER-IV

CHE(H)-CC-X PHYSICAL CHEMISTRY V- QUANTUM CHEMISTRY & SPECTROSCOPY

Time: 3 hours Maximum Marks: 75

PART-A

Answer any FIVE of the following questions. Each carry FIVE marks **5 X 5 = 25 Marks**

1. Write a short note on Hermitian operator?
2. Explain Zero-Point energy of a particle in 1D-box?
3. Write down bond order of H_2 by LCAO?
4. What do you mean by electromagnetic spectra? Enlist the different types of radiations along with their frequency and sources?
5. Explain why H_2 and N_2 molecules do not show rotational spectrum?
6. Define Coupling Constant?
7. Write down the laws of photochemistry?
8. Define photo-sensitization with suitable examples?

PART-B

Answer ALL the questions. Each carry TEN marks **5X 10 = 50 Marks**

9 (a). Write down various types of Postulates of quantum mechanics?

(Or)

(b) What is meant by an operator? Write down the Commutative and linear operators?

10.(a). Explain briefly about variation theorem

(Or)

(b) Predict the stability of He^+ in the ground state on the basis of molecular orbital theory.

11.(a). What type of molecules exhibit vibrational spectrum? Out of H_2, O_2, N_2, HCl, CO, CH_4, NO, CO_2, H_20

(or)

(b) Show diagrammatically, how the stokes and anti-stokes lines appear in the Raman spectrum of a molecule. Discuss briefly?

12.(a). Give a brief account on principle of NMR spectroscopy?

Or

(b) Write down the concept of Franck-Condon principle?

13. (a) What is quantum yield? Write down low and high quantum yields with suitable examples?

Or

(b) Write down any two actinometric measurements?

DEPARTMENT OF CHEMISTRY

DR. V. S KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM

SEMESTER 1V – CC-X1 B.Sc CHEMISTRY - ANALYTICAL CHEMISTRY-1

Credits: 4 **60 hrs (4 hours/week)**

Course Outcomes:

After completion of the course studentis able to:

- To explain fundamental laws of spectroscopy and selection rules.
- To determine the composition of metal complexes using Job's method of continuous variation and mole ratio method.
- To discussthe basic principles of instrumentation of Spectro photometer.
- To explain the theory of thermogravimetry.
- To Classify the electro analytical methods
- To describe pH metric, potentiometric and conductometric techniques.
- To describe Solvent extraction (batch, continuous and counter current extractions)
- To explain extraction of metal ions and organic species from the aqueous and nonaqueous media.
- To classify chromatographic techniques.
- To discuss Rf values, factors affecting Rf values.
- To explain Principle, Experimental procedure of TLC
- To compare various types of Paper Chromatography
- To explain the Principle, classification, Experimental procedure of Column chromatography.
- To explain Basic principles, instrumentation of HPLC.
- To sketch the block diagram HPLC.
- To discuss the applications of Column chromatography, Paper Chromatography, TLC and HPLC.

Module –I: **15**

Origin of spectra, interaction of radiation with matter, fundamental laws of spectroscopy and selection rules, validity of Beer-Lambert's law.

UV-VIS spectroscopy: Basic principles of instrumentation (choice of source, Monochromatorand detector) for single and double beam instrumentInstrumentation,Determination of composition of metal complexes using Job's method of continuous variation and mole ratio method.

Infrared Spectrometry: Basic principles of instrumentation (choice of source, monochromator& detector) for single and double beam instrument; sampling techniques. Effect and importance of isotopesubstitution.

Module –II: **10 hr**

Thermal Analysis: Theory of thermogravimetry (TG), basic principle of instrumentation.Techniques for quantitative estimation of Ca and Mg from their mixture.

Electroanalytical methods: Classification of electroanalytical methods, basic principle of pH metric, potentiometric andconductometric titrations. Techniques used for the determination of equivalence points.Techniques used for the determination of pKa values.

Module –III: **10hr**

Separation techniques:

Solvent extraction: Classification, principle and efficiency of the technique.Mechanism of extraction: extraction by solvation and chelation.Technique of extraction: batch, continuous and counter current extractions.Qualitative and quantitative aspects of solvent extraction: extraction of metal ions fromaqueous solution, extraction of organic species from the aqueous and nonaqueous media.

Module –IV: **15hr**

Chromatography-Introduction and classification 10 hours Principle, Classification of chromatographic methods, Nature of adsorbents, eluents, Rf values, factors affecting Rf values.

1. Thin layer chromatography: Principle, Experimental procedure, preparation of plates, adsorbents and solvents, development of chromatogram, detection of spots, applications and advantages.

2. Paper Chromatography: Principle, Experimental procedure, choice of paper and solvents, various modes of development- ascending, descending, radial and two dimensional, applications.

Module –V: **10hr**

Column chromatography

1. Column chromatography: Principle, classification, Experimental procedure, stationary and mobile phases, development of the Chromatogram, applications.
2. HPLC: Basic principles, instrumentation –block diagram and applications.

B. Sc. CHEMISTRY C.C. -XI - ANALYTICAL CHEMISTRY -1 LAB

Credits: 30hrs (2 hours/week)

1. Paper chromatographic separation of Fe^{3+}, Al^{3+}, and Cr^{3+}..
2. Chromatographic separation of the active ingredients of plants, flowers and juices by TLC
3. To separate a mixture of Ni^{2+} & Fe^{2+} by complexation with DMG and extracting the Ni^{2+}- DMG complex in chloroform, and determine its concentration by spectrophotometry.
4. Determine the pH of the given aerated drinks fruit juices, shampoos and soaps.

Reference Books

1. Mendham, J., *A. I. Vogel's Quantitative Chemical Analysis 6th Ed.*, Pearson, 2009.
2. Mikes, O. & Chalmes, R.A. *Laboratory Handbook of Chromatographic & Allied Methods*, Elles Harwood Ltd. London.
3. Ditts, R.V. *Analytical Chemistry: Methods of separation.* Van Nostrand, New York, 1974.

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The Semester 4 CC.-11 - Analytical Chemistry-1 question paper consists of 2 sections.

PART-A: Consists of EIGHT short answer questions carries 5 marks out of which 5 are to be answered.

PART- B: Consists of FIVE internal choice essay questions. Each question carries 10 marks .

The examiner has to choose 2 questions from each Module

The examiner is requested to set question in such a way that the entire syllabus is reflected in the question paper set by him.

The examiner is requested to give equal importance to easy, moderate and difficult questions..

MODULE	5 MARKS QUESTIONS	QUESTION SERIAL NUMBER	10 MARKS QUESTIONS	QUESTION SERIAL NUMBER	TOTAL MARKS
1	2	1, 2	1 (1 OUT OF 2 INTERNAL CHOICE)	9	20
2	2	3, 4	1 (1 OUT OF 2 INTERNAL CHOICE)	10	20
3	2	5, 6	1 (1 OUT OF 2 INTERNAL CHOICE)	11	20
4	1	7	1 (1 OUT OF 2 INTERNAL CHOICE)	12	15
5	1	8	1 (1 OUT OF 2 INTERNAL CHOICE)	13	15

Weightage for each level of Bloom's Taxonomy		
Bloom's Taxonomy level	Type of question	Weightage
Knowledge /Remember	(Define/ list/state) type.	15 marks
Comprehension/ Understand	(Classify, describe, discuss, identify, explain, report) type	30 marks
Application	(Solve, Sketch, interpret) type. Sums& Mechanisms	20 marks
Analysis	(Differentiate, distinguish, Compare) type.	15 marks
Evaluation	Argue, Defend, judge,	10marks
Create	Derive, Design, construct, Develop, formulate, investigate	

MODEL PAPER
B.Sc DEGREE EXAMINATION
SEMESTER-IV
CC-XI ANALYTICAL CHEMISTRY-1

Time: 3hrs Max.Marks: 75

PART-A 5X5=25 Marks

Answer any **FIVE** of the following questions. Each carries **FIVE** marks

1. Write a short note on Mole ratio method?
2. Explain Beer Lambert's law?
3. Explain briefly Conductometric titration of Weak acid vs Strong base?
4. How do you estimate Ca and Mg from their mixture by thermogravimetry?
5. Explain briefly Counter Continuous extraction?
6. Define Nernst distribution law?
7. Define Rf Value? What are the factors affecting Rf value?
8. Write Classification of chromatography?

PART-B5*10=50 Marks

Answer questions.Each carries**TEN**marks

9 (a). Explain Instrumentation and Sampling techniques of IR Spectroscopy?

Or

(b). Write an essay on the determination of composition of complexes by using Job's method?

10 (a). Explain theory and Instrumentation of Thermogravimetry?

Or

(b). Explain about Conductometric titrations of strong acid vs strong base?

11(a). Define solvent extraction? What is its Underlying Principle?Explain the Process?

Or

(b). Write an essay on Batch extraction?

12 (a). Write an essay on Thin Layer Chromatography?

Or

(b). Explain Paper Chromatography in detail?

13 (a). Write an essay on column chromatography?

Or

(b). Explain HPLC by drawing a block diagram?

DEPARTMENT OF CHEMISTRY

DR. V. S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM

SEMESTER -V (w.e.f. Academic Year 2022-2023)

CHE (H)-Skill Enhancement Course SEC- A1: POLYMER CHEMISTRY

Learning objective:

After completion of the course students are able to learn about:

LO1.Learning concept of polymerization

LO2. physical and chemical characteristics of polymers

LO3.To predict the atomic structure, chemical bonding, and molecular geometry based on accepted models.

LO4.To understandfree volume theory and WLF equation.

LO5. Industrial applications of polymers

Course Outcomes:

After completion of the course students are able to understand:

CO1.structure of polymers

CO2.different types of polymerizations

CO3.polymer synthesis.

CO4.the differences betweenaddition and condensed polymers.

CO5.analysing the kinetics of polymerization

POLYMER CHEMISTRY

60 hrs (4h / w) **Credits:04**

MODULE-I **12h**

Introduction of polymers:

Basic definitions, degree of polymerization ,classification of polymers- Natural and Synthetic polymers, Organic and Inorganic polymers, Thermoplastic and Thermosetting polymers, Plastics, Elastomers , Fibers and Resins, Linear ,Branched and Cross Linked polymers, Addition polymers and Condensation Polymers, mechanism of polymerization. Free radical, ionic and Zeigler – Natta polymerization.

MODULE-II **14h**

Techniques of Polymerization : Bulk polymerization , solution polymerization , suspension and Emulsion polymerization.

Molecular weights of polymers: Number average and weight average molecular weights Determination of molecular weight of polymers by Viscometry , Osmometry and light scattering methods.

MODULE-III **10h**

Kinetics of Free radical polymerization, Glass Transition temperature(Tg) and Determination of Tg:

Free volume theory, WLF equation, factors affecting glass transition temperature (Tg).

MODULE-IV **12h**

Polymer additives:

Introduction to plastic additives – fillers, Plasticizers and Softeners , Lubricants and Flow Promoters, Anti aging additives , Flame Retardants , Colourants , Blowing agents , Cross linking agents ,Photo stabilizers , Nucleating agents.

MODULE-V **12h**

Polymers and their applications:

Preparation and industrial applications of Polyethylene, Polyvinyl chloride, Teflon, Polyacrylonitrile, Terelene , Nylon6.6 silicones.

Reference Books:

1. Seymour, R.B. & Carraher, C.E. *Polymer Chemistry: An Introduction,* Marcel Dekker, Inc. New York, 1981.
2. Odian, G. *Principles of Polymerization*, 4th Ed. Wiley, 2004.
3. Billmeyer, F.W. *Textbook of Polymer Science*, 2nd Ed. Wiley Interscience, 1971.
4. Ghosh, P. *Polymer Science & Technology*, Tata McGraw-Hill Education, 1991.34
5. Lenz, R.W. *Organic Chemistry of Synthetic High Polymers.* Interscience Publishers, NewYork, 1967.

CHEMISTRY PRACTICAL – SEC-A1 LAB: POLYMER CHEMISTRY

30 Lectures

Polymer synthesis

1. Free radical solution polymerization of styrene (St) / Methyl Methacrylate (MMA) /Methyl Acrylate (MA) / Acrylic acid (AA).
   a. Purification of monomer b. Polymerization using benzoyl peroxide (BPO) / 2,2'-azo-bis-isobutylonitrile (AIBN)
2. Preparation of nylon 66/6
3. Interfacial polymerization, preparation of polyester from isophthaloyl chloride (IPC) and phenolphthalein

a. Preparation of IPC , b. Purification of IPC

b. Interfacial polymerization

4. Redox polymerization of acrylamide
5. Precipitation polymerization of acrylonitrile
6. Preparation of urea-formaldehyde resin

Polymer characterization

1. Determination of molecular weight by viscometry: (a) Polyacrylamide-aq. $NaNO_2$ solution (b) Poly vinyl proplylidine (PVP) in water
2. Determination of molecular weight by end group analysis: Polyethylene glycol (PEG) (OH group).
3. Determination of hydroxyl number of a polymer using colorimetric method.

Polymer analysis

1. Estimation of the amount of HCHO in the given solution by sodium sulphite method
2. Instrumental Techniques 3. IR studies of polymers

*at least 5 experiments to be carried out.

Reference Books:

1. Malcohm P. Stevens, Polymer Chemistry: An Introduction, 3rd Ed.
2. Harry R. Allcock, Frederick W. Lampe and James E. Mark, Contemporary Polymer Chemistry, 3rd ed. Prentice-Hall (2003)
3. Fred W. Billmeyer, Textbook of Polymer Science, 3rd ed. Wiley-Interscience (1984)
4. Joel R. Fried, Polymer Science and Technology, 2nd ed.Prentice-Hall (2003)
5. Petr Munk and Tejraj M. Aminabhavi, Introduction to Macromolecular Science, 2nd ed.John Wiley & Sons (2002)
6. L. H. Sperling, Introduction to Physical Polymer Science, 4th ed.John Wiley & Sons (2005)
7. Malcolm P. Stevens, Polymer Chemistry: An Introduction, 3rd ed.Oxford University Press (2005)

8. Seymour/ Carraher's Polymer Chemistry, 9th ed.by Charles E. Carraher, Jr. (2013).

BLUE PRINT of SEC-A1- POLYMER CHEMISTRY

Important Tips for Setting Question Paper

- ✔ The examiner is requested to set question in such a way that the entire syllabus is reflected in the question paper set by him/her.
- ✔ It is suggested that the question writer should use his/her judgment in assigning difficulty value to each question. Following scale should guide you to set questions at different difficulty levels and use the **Bloom's Taxonomy** action verbs given below.

Bloom's Level	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating
% of Weightage	30	20	20	15	10	5

Question Paper Pattern

- ✔ The Semester question paper consists of 2 sections.

  PART-A: Consists of **EIGHT** short answer questions carries **5** marks out of which **5** are to be answered.

  PART- B: Consists of **FIVE** internal choice essay questions. Each question carries **10** marks.
- ✔ The examiner has to choose **2** questions from each module.

Sl. No	Modules	5 M Questions	Question Serial Number	10 M Questions	Question Serial Number	Weightage per Module
1	Module 1	2	1, 2	2	9 (a) or 9 (b)	20 Marks
2	Module 2	2	3	2	10 (a) or 10 (b)	20 Marks
3	Module 3	1	4,5	2	11 (a) or 11 (b)	15 Marks
4	Module 4	2	6, 7	2	12 (a) or 12 (b)	20 Marks
5	Module 5	1	8	2	13 (a) or 13 (b)	17 Marks

MODEL PAPER-1

B.Sc, DEGREE EXAMINATION

SEMESTER-V

Skill Enhancement Course SEC-A1 - POLYMER CHEMISTRY

Maximum Marks: 75 Time: 3 hours

PART-A

5X5-25 Marks

Answer any FIVE of the following questions. Each carries FIVE marks

1. What are addition and condensation polymers?
2. Explain Zeigler Natta polymerization.
3. What are weight average and number average molecular weights.
4. Write about suspension polymerization
5. Explain Free Volume Theory
6. What are nucleating agents?
7. Write about plasticizers
8. Write preparation of PVC.

PART-B

5X 10=50 Marks

Answer ALL the questions. Each carries TEN marks

9 (a). Explain classification of polymers.

(or)

(b) Explain the mechanism of free radical and cationic polymerization

10 (a) Explain bulk and solution polymerization.

(or)

(b). Explain the viscometric method for determination of polymer molecular weight.

11.(a) Explain the kinetics of free radical polymerization

(or)

(b) Explain the determination of Tg and factors affecting Tg.

12 (a) Explain anti aging additives and softners

(or)

(b). Write flame retardants and crosslinking agents

13. (a) Explain synthesis and applications of PAN and Teflon

(or)

(b) Explain synthesis and applications of silicones and Nylon 66

DEPARTMENT OF CHEMISTRY

DR. V. S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM

SEMESTER -V (w.e.f. Academic Year 2022-2023)

CHE (H)-Skill Enhancement Course SEC- A2: MEDICINAL CHEMISTRY

Credits 4 **60 hrs (4 h / w)**

I. Learning Outcomes:

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

1. Understand the terms used in medicinal chemistry and properties of drugs.
2. Acquire knowledge about pharmacokinetics and pharmacodynamics of the drugs.
3. Explain different sources and classes of drugs.
4. Write the nomenclature and synthesis of drugs.
5. Apply the concept of structure activity relationship in studies of drug bioactivity.
6. Explain the mechanism of action of drugs.
7. Describe the causes, treatments of cancer and classification of anticancer agents.

II. Syllabus:(Total Hours: 90 including Teaching, Lab, Field Skills Training, tests etc.)

Module1

Drug's introduction **12h**

Definitions – Activity, potency, leads, analogues. receptors, ligand, pharmacophore, drug. SAR and QSAR with one example. Modern-day drug discovery and design. Desirable properties of drugs – Bioavailability, Solubility, Structure and Stability. Sources of drugs, drug administration.

Module 2

Drug action **12h**

The pharmacokinetic phase (ADME) – Absorption, Distribution, Metabolism, Excretion. Lead optimisation and ADME. The pharmacodynamic phase introduction. Nomenclature of drugs – Chemical name, generic name and trade names with examples. Classification of drugs based on Chemical structure, Pharmacological action, Physiological classification.

Module 3

Drug Synthesis **12h**

Structure, synthesis, mode of action, properties and uses of the following drugs.

Promazine (tranquillizers), Levodopa (antiparkinsonism agents), Frusemide (antihypertensive drugs), Chloroquine (antimalarials), Omeprazole (antiulcer agents), Metformin (antidiabetics).

Module 4

Structure Activity Relationship (SAR) of representative drugs **12h**

Phenothiazines (tranquillizers), Sulphonamides (antibacterial) Penicillins and Cephalosporins (antibiotics), 4-substituted quinolines (antimalerials).

Module 5

Cancer therapy **12h**

Cancer introduction, factors responsible for cancer, types of cancer and various treatments of cancer. Classification of chemotherapeutic agents.DNA. Alkylating agents and DNA intercalating agents. Natural products as anticancer agents. SAR of Combretastatin A-4.

III. Recommended books/References:

1. Textbook of Medicinal Chemistry Vol I by V. Alagarsamy.
2. Textbook of Medicinal Chemistry Vol II by V. Alagarsamy.
3. Medicinal Chemistry by Ashutosh Kar
4. An Introduction to Medicinal Chemistry fifth edition by Graham L. Patrick.
5. Medicinal Chemistry Second Edition by Gareth Thomas.
6. Fundamentals of Medicinal Chemistry by Gareth Thomas.
7. Textbook of Organic Medicinal and Pharmaceutical Chemistry by Wilson and Gisvold's.
8. Foye's Principles of Medicinal Chemistry by Thomas L. Lemke, David A. Williams, Victoria F. Roche, S. William Zito.
9. Burger's Medicinal Chemistry and Drug Discovery: Therapeutic Agents: Volume – 5.
10. https://www.cancer.gov/about-cancer
11. https://www.cancer.gov/about-cancer/treatment/types
12. Tubulin-Interactive Natural Products as Anticancer Agents,Journal of Natural Products 2009, 72, 3, 507-515 (Review)
13. Essentials of Foye's Principles of Medicinal Chemistry by Thomas L. Lemke, David A. Williams, Victoria F. Roche, S. William Zito.

Course – SEC A2 LAB: Medicinal Chemistry Practical Syllabus

IV. Laboratory-Skill Outcomes:

At the end of the course students will be able to

1. Understand the apparatus handling technique.
2. Demonstrate a clear understanding of the reactions of key organic functional groups.
3. Perform synthesis of drugs.
4. Acquire skill for workup procedures.
5. Understand the concept of purification of drugs.
6. Discuss the importance of 'green chemistry' considerations during drug manufacture.

V. Practical (Laboratory) Syllabus:

Drug Preparation (Any Four) **30h**

a) Aspririn
b) Coumarin–3–Carboxylic Acid
c) Isoniazid
d) Isatin
e) Paracetamol
f) Phenyl-azo-beta-naphthol

VI. Recommended books/References:

1. Advanced practical Medicinal Chemistry by Ashutosh Kar

Important Tips for Setting Question Paper

- ✔ The examiner is requested to set question in such a way that the entire syllabus is reflected in the question paper set by him/her.
- ✔ It is suggested that the question writer should use his/her judgment in assigning difficulty value to each question. Following scale should guide you to set questions at different difficulty levels and use the **Bloom's Taxonomy**action verbs given below.

Bloom's Level	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating
% of Weightage	30	20	20	15	10	5

Question Paper Pattern

- ✔ The Semester question paper consists of 2 sections.
  PART-A: Consists of **EIGHT** short answer questions carries **5** marks out of which **5** are to be answered.
  PART- B: Consists of **FIVE** internal choice essay questions. Each question carries **10** marks.
- ✔ The examiner has to choose **2** questions from each module.

Sl. No	Modules	5 M Questions	Question Serial Number	10 M Questions	Question Serial Number	Weightage per Module
1	Module 1	2	1, 2	2	9 (a) or 9 (b)	20 Marks
2	Module 2	2	3	2	10 (a) or 10 (b)	20 Marks
3	Module 3	1	4,5	2	11 (a) or 11 (b)	15 Marks
4	Module 4	2	6, 7	2	12 (a) or 12 (b)	20 Marks
5	Module 5	1	8	2	13 (a) or 13 (b)	18 Marks

MODEL PAPER

B.Sc., DEGREE EXAMINATION SEMESTER-V/VI

CHE(H)- SEC- A2: MEDICINAL CHEMISTRY

Time: 3h Maximum Marks: 75

PART-A

Answer any FIVE of the following questions. Each carries FIVE marks 5X5=25 Marks

1. Define the terms activity and potency.
2. Name any two types of drugs. Give examples.
3. Explain nomenclature of drugs.
4. Discuss about the sources of drugs.
5. Give the synthesis and mode of action of promazine.
6. Give the synthesis and mode of action of Levodopa
7. Write about antibacterial drugs and give examples
8. Explain various factors responsible for cancers

SECTION - B

Answer ALL questions.

Each answer carries 10 marks (5x10=50 Marks)

9. a)Explain the desirable properties of drugs. (or)
   b) Describe briefly about SAR and ASAR with one example.
10. a) Explain ADME of a drug. (or)
    b) Write about classification of drugs.
11. a) Explain structure , synthesis and mode of action of Chloroquin (or).
    b) Write the structure, synthesis and mode of action of Omeprazole
12. a).Write about SAR of sulphonamides (or)
    b). Explain SAR of Cephalosporins
13. a). Write about classification of chemotheraupitic agents (or)
    b). Write about various types of cancers and treatments available.

DEPARTMENT OF CHEMISTRY

DR. V. S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM

SEMESTER -V (w.e.f. Academic Year 2022-2023)

CHE (H)-Skill Enhancement Course

SEC- B1: BASIC ANALYTICAL METHODS IN CHEMISTRY

Credits:4 **Teaching Hours:60Hours(4h/W)**

I. Learning objective:

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

1. Identify the importance of solvent extraction and ion exchange method.
2. Acquire knowledge on the basic principles of volumetric analysis and gravimetric analysis.
3. Demonstrate the usage of common laboratory apparatus used in quantitative analysis.
4. Understand the theories of different types of titrations.
5. Gain knowledge on different types of errors and the minimization methods.

II. Course Outcomes:

After completion of the course students are able to:

CO1. Describe the analytical methods in chemistry.

CO2: Explain the concepts of primary and secondary standards.

CO3: Describe the acid-base titrations.

CO4. Explain principle and methods involved in gravimetric analysis.

CO5. Describe various types of errors with suitable examples.

CO6.Explain the methods to convert permanent hard water to soft water

SEMESTER-V/ CHE(H)-SKILL ENHANCEMENT COURSE-B1

BASIC ANALYTICAL METHODS IN CHEMISTRY

Module-I: Volumetric Analysis **15H**

A brief introduction to analytical methods in chemistry.

Principles of volumetric analysis, concentration terms- Molarity, Molality, Normality,v/v, w/v, ppm and ppb, preparing solutions- Standard solution, primary standards and secondary standards.

Description and use of common laboratory apparatus- volumetric flask, burette, pipette, beakers, measuring cylinders.

Module-II: Quantitative analysis-1 **10H**

Principles of volumetric analysis: Theories of acid-base (including study of acid-base titration curves), redox, complex metric, iodometric and precipitation titrations-choice of indicators for the saturations.

Module-III:Quantitative analysis-2 **10H**

Principlesofgravimetricanalysis:precipitation,coagulation,peptization,coprecipitation, post precipitation, digestion, filtration, and washing of precipitate, dryingandignition.

Module-IV:Treatment of analytical data **15H**

Types of errors- Relative and absolute, significant figures and its importance, accuracy -methods of expressing accuracy, errors- Determinate and indeterminate and minimization of errors, precision-methods of expressing precision, standard deviation and confidence limit. The correlation coefficient.

Module-V: Analysis of water **10H**

Determination of dissolved solids, total hardness of water, turbidity, alkalinity, Dissolved oxygen, COD, and determination of chloride using Mohr's method.

CHE(H)-SEC-B1–BASIC ANALYTICAL METHODS IN CHEMISTRY-LAB(30Hours)

Hours perweek:2 **Evaluation:50marks** **Credits:1**

Learning Outcomes:

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

1. Estimate Iron (II) using standard Potassium dichromate solution
2. Learn the procedure for the estimation of total hardness of water
3. Demonstrate the determination of chloride using Mohr's method
4. Acquire skills in the operation and calibration of pH meter
5. Perform the strong acid vs strong base titration using pH meter

Practical (Laboratory)Course

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

ReferenceBooks:

Theory:

1. Fundamentals of Analytical Chemistry by F.James Holler, Stanley R Crouch, Donald M.Westand Doùglas A.Skoog, Ninth edition, Cengage.
2. Analytical Chemistry by Gary D.Christian, Purnendu K.Dasgupta and KevinA.Schug,Seventh edition, Wiley.
3. Quantitative analysis by R.A.DayJr. And A.L.Underwood, Sixth edition, Pearson.
4. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
5. Text book of Environmental Chemistry and Pollution Control by S.S.Dara and D.D.Mishra, Revised edition, S Chand & CoLtd.

Practical:

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

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CHE(H)-SEC B1 –BASIC ANALYTICAL METHODS IN CHEMISTRY

The Semester question paper consists of 2 sections.

PART-A: Consists of EIGHT short answer questions carries 5 marks out of which 5 are to be answered.PART- B: Consists of FIVE internal choice essay questions. Each question carries 10 marks. The examiner has to choose 2 questions from each Module

The examiner is requested to set question in such a way that the entire syllabus is reflected in the question paper set by him.

The examiner is requested to give equal importance to easy, moderate and difficult questions.

MODULE	5 MARKS QUESTIONS	QUESTION SERIAL NUMBER	10 MARKS QUESTIONS	QUESTION SERIAL NUMBER	TOTALMARKS
1	2	1, 2	1(1 OUTOF2 INTERNALCHOICE)	9	20
2	2	3,4	1(1 OUTOF2 INTERNALCHOICE)	10	20
3	1	5	1(1 OUTOF2 INTERNALCHOICE)	11	15
4	2	6,7	1(1 OUTOF2 INTERNALCHOICE)	12	20
5	1	8	1(1 OUTOF2 INTERNALCHOICE)	13	15

Weightage for each level of Bloom's Taxonomy		
Bloom's Taxonomy level	Type of question	Weightage
Knowledge/Remember	(Define/list/state) type.	15marks
Comprehension /Understand	(Classify, describe, discuss, identify, explain, report)type	30marks
Application	(Solve, Sketch, interpret)type. Sums& Mechanisms	20marks
Analysis	(Differentiate, distinguish, Compare) type.	15marks
Evaluation	Argue, Defend, judge,	10marks
Create	Derive,Design,construct,Develop, formulate,investigate	

MODEL PAPER

B.Sc., DEGREE EXAMINATION SEMESTER-V/VI

CHE(H)-SEC-B1 – BASIC ANALYTICAL METHODS IN CHEMISTRY

Time:3hours MaximumMarks:75

PART-A

Answer any FIVE of the following questions. Each carries FIVE marks 5X5=25 Marks

9. What are primary and secondary standards?
10. Give a brief introduction to analytical methods in chemistry?
11. Explain Iodometric titration with a suitable example?
12. Discuss the choice of indictors for the titrations with suitable examples.?
13. Define Precipitation and Coagulation?
14. What is Correlation coefficient?
15. What are the methods of expressing Accuracy?
16. Define Dissolved Oxygen& COD?

PART-B

Answer ALL the questions. Each carries TEN marks 5X10=50Marks

9 (a). Write down principle of volumetric analysis and explain the concentration terms of Molarity and Normality with examples?

(Or)

(b)Write the Description and use of common laboratory apparatus?

10.(a).Describe the acid-base titrations in detailed?

(Or)

(b)Explain the complex metric titrations with examples?

11.(a).What is the principle of gravimetric analysis? Discuss the concepts of peptization and filtration?

(or)

(b)Describe the Co-Precipitation andPost-Precipitation in detailed?

12.(a).Discuss various types of errors with suitable examples.

Or

(b)Give a brief account on standard deviation, accuracy and precision?

13.(a)Describe the methods to convert permanent hard water to soft water?

Or

(b)Discuss the determination of chloride using Mohr's method?

DEPARTMENT OF CHEMISTRY
DR. V. S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM
B. Sc, CHEMISTRY HONOURS
SEC B2, SEMESTER-V
ELECTROCHEMISTRY
(w.e.f. Academic Year 2022-2023)

Credits 4 **60 hrs (4 h / w)**

Course Outcomes

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

CO 1: Define the terms involved in Phase Equilibria, Solutions, Conductance and Electrochemistry.

CO 2: State the Faraday's laws and the Kohlrausch's law of independent migration of ions.

CO 3: Draw the schematic diagrams of instruments used in Conductance and Electrochemistry

CO 4: Interpret the graphs based on Conductometric titrations.

CO 5: Define and explain the terms involved giving examples

Module 1 **12h**

Electrolysis and Conductance

Electronic and Electrolytic Conductance,Classification of Electrolytes, Electrolysis, Products of electrolysis, Quantitative aspects of Faraday's laws of electrolysis and its Significance, Coulometers, Specific Conductance, Molar Conductance, Equivalent Conductance and effect of dilution, The Cell Constant. Kohlrausch law of Independent Migration of Ions and its applications.

Module 2 **12h**

Theories of Electrolysis and Electrolytic Transference

Arrhenius theory of electrolytic dissociation, Debye-Huckel-Onsager equation, Wien effect, Debye-Falkenhagen effect, Ionic Strength,Walden's rule, Ionic velocity, mobility and their determination, transference number and its relation to ionic mobility, determination of transference number using Hittorfmethod, Conductometric titrations.

Module 3 **12h**

Electromotive Force

Electrochemical Cells: Rules of oxidation/reduction of ions based on half-cell potentials, reversible and irreversible cells with examples. Electromotive force of a cell and its measurement, Types of electrodes with examples: Metal – metal ion, Gas electrode, Inert electrode, Redox electrode, Metal-metal insoluble salt- salt anion. Nernst equation; Standard electrode (reduction) potential and electrochemical series.

Module 4 **12h**

Application of EMF measurements

Application of EMF measurements in determining (i) free energy, enthalpy and entropy of a cell reaction, (ii) equilibrium constants, and (iii) pH values, using hydrogen, quinone- hydroquinone electrodes. Concentration cells with and without transference, liquid junction potential, Qualitative discussion of potentiometric titrations (acid-base and oxidation-reduction only).

Module 5 **12h**

Batteries and Fuel cells

Batteries: Primary and secondary batteries, battery components and their role and characteristics of battery. Working of following batteries: Lead Acid Battery, Nickel based batteries, Sodium based batteries, Lithium based batteries – Li-Ion & Li-poly.

Fuel cells: Introduction, Classification, Choice of electrolyte. Electrodes and requirement of Electrocatalysis. Working of Hydrogen oxygen fuel cell and hydrocarbon – oxygen fuel cell.

List of Reference Books for Theory:

1. Castellan, G.W. (2004),Physical Chemistry, Narosa.
2. Kapoor, K.L. (2015),A Textbook of Physical Chemistry,Vol 1, 6th Edition, McGraw Hill Education.
3. Kapoor, K.L. (2013),A Textbook of Physical Chemistry,Vol 3, 3rd Edition, McGraw Hill Education.
4. B.R.Puri, L.R.Sharma, M.S.Pathania, (2017),Principles of Physical Chemistry, Vishal.
5. J. N. Gurtu, Physical Chemistry Vol-III, A Pragati edition. 2
6. N. B. Laxmeshwar, S. M. Malushte, A. S. Mulye, V. N. Kulkarni, Concepts of Physical Chemistry, Chetana Prakashan.
7. Gurdeep Raj, Advanced Physical Chemistry Goel Publication.

LABORATORY COURSE B. Sc, CHEMISTRY HONOURS SEC B2, SEMESTER-V, ELECTROCHEMISTRY
(At the end of Semester-V)

Practicals **30hrs (2 h / w)**

1. Verification of Debye-Huckel-Onsager equation to dilute solutions of KCl by conductometric method.
2. To determine the percentage concentration and strength of a strong acid and weak acid present in a mixture by potentiometric titration.
3. Conductometric titration of Lead Nitrate against Sodium Sulphate and to determine the solubility of Lead Sulphate.
4. To determine composition of Zinc Ferrocyanide complex by potentiometric titration.
5. To determine the dissociation constant of a weak monobasic acid using pH metry.
6. To determine Standard Reduction Potential of Zn++/Zn.
7. To determine Standard Reduction Potential of Cu++/Cu.

List of Reference Books for Practical

1. Systematic experimental physical Chemistry by S.W. Rajbhoj, Dr. T. K. Chondhekar, Anjali Publication, Aurangabad.
2. Practical Chemistry by O.P. Pandey, D. N. Bajpai, S. Giri, S. Chand Publication
3. Khosla, B. D., Garg, V. C. &Gulati, A. Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).

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SEC B2: Electro Chemistry – IV

Important Tips for Setting Question Paper

- ✔ The examiner is requested to set question in such a way that the entire syllabus is reflected in the question paper set by him.
- ✔ It is suggested that the question writer should use his/her judgment in assigning difficulty value to each question. Following scale should guide you to set questions at different difficulty levels and use the **Bloom's Taxonomy** action verbs given below.

Bloom's Level	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating
% of Weightage	30	20	20	15	10	5

Question Paper Pattern

- ✔ The Semester question paper consists of 2 sections.
  PART-A: Consists of **EIGHT** short answer questions carries **5** marks out of which **5** are to be answered.
  PART- B: Consists of **FIVE** internal choice essay questions. Each questioncarries **10** marks.
- ✔ The examiner has to choose **2** question from each module.

SI. No	Modules	Name of the Module	5 M Questions	Question Serial Number	10 M Questions	Question Serial Number	Weightage per Module
1	1	Electrolysis and Conductance	2	1, 2	2	9 (a) or 9 (b)	20 Marks
2	2	Theories of Electrolysis and Electrolytic Transference	2	3, 4	2	10 (a) or 10 (b)	20 Marks
3	3	Electromotive Force	1	5	2	11 (a) or 11 (b)	15 Marks
4	4	Application of EMF measurements	2	6, 7	2	12 (a) or 12 (b)	20 Marks
5	5	Batteries and Fuel cells	1	8	2	13 (a) or 13 (b)	19 Marks

DEPARTMENT OF CHEMISTRY
DR. V. S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM
MODEL PAPER
B. Sc, CHEMISTRY HONOURS EXAMINATIONS
SEC B2, SEMESTER-V ELECTRO CHEMISTRY

Time: 3 hours **Maximum Marks: 75**

PART-A

5 X 5 = 25 Marks

Answer any **FIVE** of the following questions.

9. Define electronic and electrolytic conductors with examples.
10. Define specific conductance and equivalent conductance and explain the effect of dilution on it.
11. Write the postulates of Arrhenius theory of electrolytic dissociation.
12. What is Debye-Falkenhagen effect.
13. Discuss about reversible and irreversible cells with examples.
14. Explain liquid junction potential.
15. Determine pH value using hydrogen electrode.
16. Give the differences between primary and secondary batteries.

PART-B

5 X 10 = 50 Marks

Answer **ALL** the questions.

9 (a) Explain Faraday's laws of electrolysis and its Significance.

(or)

(b) What is Kohlrausch law of independent migration of ions and write any three applications.

10 (a) determination the transference number using Hittorf method.

(or)

(b) Discuss the Debye-Huckel-Onsager equation.

11 (a) Explain the different types of electrodes.

(or)

(b) Discuss the Nernst equation and write about Standard electrode (reduction) Potential.

12 (a) Write about potentiometric titrations involving acid-base and oxidation-reduction reactions.

(or)

(b) Determine free energy, enthalpy and entropy of a cell reaction using EMF.

13 (a) Construct the lead acid battery and give the principle and working.

(or)

(b) Construct the hydrogen – oxygen fuel cell and give the principle and working.

DEPARTMENT OF CHEMISTRY

DR. V. S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM

SEMESTER V (w.e.f. Academic Year 2022-2023)

CHE (H)-Skill Enhancement Course

SEC- C1: NANOSCALE MATERIALS & APPLICATIONS

Total Credits: 05 (Theory-04, Practical-01) **(Lectures: Theory- 60, Practical-30)**

Learning Objectives:

The aim of this course is to introduce materials at nanoscale, their preparation, characterization and applications.

Course Outcomes:

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

1. Understand the concept of nanodimensions.
2. Know the various methods of preparation of nanomaterials.
3. Know the different characterization techniques used for the analysis of nanomaterials and understand the basic principle behind these techniques.
4. Understand the optical and conducting properties of nanostructures.
5. Appreciate the real life applications of nanomaterials.

Module 1: Introduction to nano dimensions(Lectures: 10)

0D, 1D, 2D nanomaterials, Quantum Dots, Nanoparticles, Nanostructures (nanowires, thin films, nanorods), carbon nanostructures (carbon nanotubes, carbon nanofibers, fullerenes), Size Effects in nano systems, Quantum confinement and its consequences, Semiconductors.Band structure and band gap.

Module 2: Preparation of nanomaterials (Lectures:14)

Top down and Bottom up approach, Photolithography. Ball milling.Vacuum deposition.Physical vapor deposition (PVD), Chemical vapor deposition (CVD), Thermal decomposition, Chemical reduction, Sol- Gel synthesis, Hydrothermal synthesis, Spray pyrolysis,Electrochemical deposition, Pulsed Laser deposition.

Module 3: Characterization techniques *(Basic working principles and interpretation of experimental data using these techniques need to be covered)* **(Lectures:12)**

UV-visible spectroscopy, X-ray diffraction (Powder and Single Crystal), Raman Spectroscopy, Scanning Electron Microscopy (SEM), Transmission Electron Microscopy (TEM), Energy Dispersive X-ray Spectroscopy (EDX), X-ray Photoelectron Spectroscopy (XPS), Brunauer-Emmett-Teller (BET) Surface area measurement and Thermogravimetric analysis (TG).

Module 4: Optical Properties(Lectures:10)

Surface plasmon resonance, Excitons in direct and indirect band gap semiconductor nanocrystals. Radiative processes: General absorption, emission and luminescence (fluorescence and photoluminescence). **(Lectures:12)Conducting properties**-Carrier transport in nanostructures. Tunneling and hoping conductivity. Defects and impurities: Deep leveland surface defects.

Module 5: Applications(Lectures:14)

Nanomaterials as Catalysts, semiconductor nanomaterials as photocatalysts, Nanocomposites as catalysts. Carbon nanostructures as catalytic nanoreactors, metal and metal oxides confined inside carbon nanostructures, Nanowires and thin films for photonic devices (LEDs, solar cells, transistors).

Practicals :

(Credits: 1, Laboratory periods: 30)

Chemistry Lab: Nanoscale materials and their applications

*At least **04 experiments** from the following:*

1. Synthesis of metal nanoparticles by chemical reduction method.
2. Synthesis of semiconductor nanoparticles.
3. Surface Plasmon study of metal nanoparticles by UV-Visible spectrophotometer.
4. XRD pattern of nanomaterials and estimation of particle size. (Students can be provided with XRD patterns of known materials and asked to interpret the data.)
5. To study the effect of size on color of nanomaterials.
6. To prepare composite of CNTs with other materials.
7. Growth of quantum dots by thermal evaporation.
8. Prepare a disc of ceramic of a compound using ball milling, pressing and sintering, and study its XRD.
9. Fabricate a thin film of nanoparticles by spin coating (or chemical route) and study transmittance spectra in UV-Visible region.

References:

1. West, A. R.(2014),**Solid State Chemistry and Its Application**, Wiley
2. Smart, L. E.; Moore, E. A.(2012),**Solid State Chemistry An Introduction**, CRC Press Taylor & Francis.
3. Rao, C. N. R.; Gopalakrishnan, J.(1997),**New Direction in Solid State Chemistry**, Cambridge University Press.
4. Poole, Jr.; Charles P.; Owens, Frank J.;(2003), **Introduction to Nanotechnology**, John Wiley and Sons.
5. Chattopadhyay, K.K.; Banerjee, A. N.(2009),**Introduction to Nanoscience and Technology**

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CHE(H)-SKILL ENHANCEMENT COURSE-C1 – NANOSCALE MATERIALS & APPLICATIONS

The Semester question paper consists of 2 sections.

PART-A: Consists of EIGHT short answer questions carries 5 marks out of which 5 are to be answered.

PART- B: Consists of FIVE internal choice essay questions. Each question carries 10 marks. The examiner has to choose 2 questions from each Module

The examiner is requested to set question in such a way that the entire syllabus is reflected in the question paper set by him.

Theexaminerisrequestedtogiveequalimportancetoeasy,moderateanddifficultquestions.

MODULE	5 MARKS QUESTIONS	QUESTION NUMBER	10 MARKS QUESTIONS	QUESTIONUMBER	TOTALMARKS
1	2	1, 2	1(1 OUTOF2 INTERNALCHOICE)	9	20
2	2	3,4	1(1 OUTOF2 INTERNALCHOICE)	10	20
3	1	5	1(1 OUTOF2 INTERNALCHOICE)	11	15
4	2	6,7	1(1 OUTOF2 INTERNALCHOICE)	12	20
5	1	8	1(1 OUTOF2 INTERNALCHOICE)	13	15

Weightage for each level of Bloom's Taxonomy		
Bloom's Taxonomy level	Type of question	Weightage
Knowledge/Remember	(Define /list /state) type.	15marks
Comprehension	(Classify, describe, discuss, identify, explain, report) type	30marks
Application	(Solve, Sketch, interpret) type. Sums & Mechanisms	20marks
Analysis	(Differentiate, distinguish, Compare) type.	15marks
Evaluation	Argue, Defend, judge,	10marks
Create	Derive, Design, construct, Develop, formulate, investigate	

MODEL PAPERB.Sc., DEGREE EXAMINATION PAPER-C1
SEMESTER-V/VI
CHE(H)-COURSE-SEC-C1 – NANOSCALE MATERIALS & APPLICATIONS

Time:3hours MaximumMarks:75

PART-A

Answer any FIVE of the following questions. Each carry FIVE marks 5X5=25 Marks

1. What are carbon nanotubes and nanofibers?
2. Explain briefly about size effects in nano systems?
3. Explain about Electrochemical deposition?
4. What is hydrothermal synthesis and explain it?
5. Explain the basic principle and applications of UV-Visible spectroscopy in nano materials?
6. What are excitons and holes and explain it briefly?
7. What is tunnelling effect in semiconductors?
8. Write short notes on Carbon nanostructures as catalytic nanoreactors?

PART-B

AnswerALLthequestions.EachcarryTEN marks 5X10=50Marks

9 (a). Explain brieflyaboutsemiconductor? Write down band gap and band structures in semiconductors?

(Or)

(b)Discuss the classification and applications of Nanomaterials?

10.(a).What is Chemical vapor deposition (CVD) and explain it briefly?

(Or)

(b)Give a brief account on preparation of nano particle by top-down and bottom-up approch?

11.(a).How can you distinguish the nano particle by X-ray diffraction powder method?

(or)

(b)What is the principle of scanning electron microscopy(SEM) and how do you characterize the nano particle size by using SEM?

12.(a).What is meant by surface plasmon resonance and write down its applications?

Or

(b) Explain about the concept of radiative transition?Write about fluorescence and phosphorescence?

13.(a)Give a brief account on photonic devices?

Or

(b)Why should we use nanomaterials as Catalysts and write its applications?

DEPARTMENT OF CHEMISTRY

DR. V. S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM

SEMESTER V (w.e.f. Academic Year 2022-2023)

CHE (H)-Skill Enhancement Course (SEC)- C2: ENVIRONMENTAL CHEMISTRY

Total Credits: 05 (Theory-04, Practical-01) (Lectures: Theory- 60, Practical-30)

I. Learning Outcomes:

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

1. Understand the environment functions and how it is affected by human activities.
2. Acquire chemical knowledge to ensure sustainable use of the world's resources and ecosystems services.
1. Engage in simple and advanced analytical tools used to measure the different types of pollution.
4. Explain the energy crisis and different aspects of sustainability.
5. Analyze key ethical challenges concerning biodiversity and understand the moral principles, goals and virtues important for guiding decisions that affect Earth's plant and animal life.

II Syllabus :*(Total Hours: 90, including Teaching, Lab, Field Skills Training, Unit tests etc.)*

UNIT-I Introduction 10h

Environment Definition – Concept of Environmental chemistry- Scope and importance of environment in nowadays – Nomenclature of environmental chemistry – Segments of environment– Effects of human activities on environment – Natural resources–Renewable Resources–Solar and biomass energy and Non renewable resources – Thermal power and atomic energy – Reactions of atmospheric oxygen and Hydro logical cycle.

UNIT-II

Air Pollution 10h

Definition – Sources of air pollution – Classification of air pollution – Ambient air quality standards- Climate change – Global warming – Pollution from combustion systems- Acid rain –Photochemical smog – Greenhouse effect – Formation and depletion of ozone – Bhopal gas disaster–Instrumental techniques to monitor pollution – Controlling methods of air pollution.

UNIT-III

Water pollution 10h

Unique physical and chemical properties of water – Water quality standards and parameters – Turbidity- pH Dissolved oxygen – BOD, COD, Suspended solids, total dissolved solids, alkalinity–Hardness of water–Methods to convert temporary hard water in to soft water – Methods to convert permanent hard water into soft water – eutrophication and its effects –Industrial waste water treatment.

UNIT-IV

Chemical Toxicology 10h

Toxic chemicals in the environment – effects of toxic chemicals – cyanide and its toxic effects – pesticides and its biochemical effects – toxicity of lead, mercury, arsenic and cadmium- Solid waste management.

UNIT-V

Ecosystem and biodiversity 10h

Ecosystem: Concepts–structure–Functions and types of ecosystem–Abiotic and biotic components – Energy flow and Energy dynamics of ecosystem– Food chains – Food web– Tropic levels– Biogeochemical cycles (carbon, nitrogen and phosphorus)

Biodiversity

Definition – level and types of biodiversity – concept- significance – magnitude and distribution of biodiversity–trends-bio geographical classification of India–biodiversity at national, global and regional level.

III. List of Reference books:

1. Fundamentals of ecology by M.C.Dash
2. A Text book of Environmental chemistry by W. Moore and F.A. Moore
3. Environmental Chemistry by Samir k.Banerji
4. Water pollution, Lalude, MC Graw Hill
5. Environmental Chemistry, Anil Kumar De, Wiley Eastern ltd.
6. Environmental analysis, SM Khopkar (IIT Bombay)
7. Environmental Chemistry by BK Sharma & H Kaur, Goel publishing house.
8. Fundamentals of Environmental Chemistry, Manahan, Stanley. E
9. Applications of Environmental Chemistry, Eugene R. Wiener
10. Web related references suggested by teacher.

Course6-D: Environmental Chemistry – Practical syllabus

IV. Lab work-Skills Outcomes:

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

1. List out, identify and handle various equipment in Chemistry lab.
2. Learn the procedures of preparation of standard solutions.
3. Demonstrate skills in operating instruments.
4. Acquire skills in handling spectrophotometer.
5. Analyse water and soil samples.

V. Practical (Laboratory) Syllabus: (30hrs) (Max.50Marks).

1. Identification of various equipment in the laboratory.
2. Determination of carbonate and bicarbonate in water samples by double titration method.
3. Determination of hardness of water using EDTA

a) Permanent hardness b) Temporary hardness

4. Determination of Chlorides in water samples by Mohr's method.
5. Determination of pH, turbidity and total solids in water sample.
6. Determination of Ca^{+2} and Mg^{+2} in soil sample by flame photometry.
7. Determination of PH in soil samples using pH metry.

VI. List of Reference books:

1. A Text Book of Quantitative Inorganic Analysis (3rd Edition)–A.I.Vogel
2. Water pollution, Lalude, MC Graw Hill
3. Environmental analysis, SM Khopkar (IIT Bombay)
4. Web related references suggested by teacher.

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CHE(H)-SKILL ENHANCEMENT COURSE-SEC-C2 – ENVIRONMENTAL CHEMISTRY

The Semester question paper consists of 2 sections.

PART-A: Consists of EIGHT short answer questions carries 5 marks out of which 5 are to be answered.

PART- B: Consists of FIVE internal choice essay questions. Each question carries 10 marks. The examiner has to choose 2 questions from each Module.

The examiner is requested to set question in such a way that the entire syllabus is reflected in the question paper set by him.

The examiner is requested to give equal importance to easy, moderate and difficult questions.

MODULE	5 MARKSQUESTIONS	QUESTION SERIALNUMBER	10 MARKSQUESTIONS	QUESTION SERIALNUMBER	TOTALMARKS
1	2	1, 2	1(1 OUTOF2 INTERNALCHOICE)	9	20
2	2	3,4	1(1 OUTOF2 INTERNALCHOICE)	10	20
3	1	5	1(1 OUTOF2 INTERNALCHOICE)	11	15
4	2	6,7	1(1 OUTOF2 INTERNALCHOICE)	12	20
5	1	8	1(1 OUTOF2 INTERNALCHOICE)	13	15

Weightage for each level of Bloom's Taxonomy		
Bloom's Taxonomy level	Type of question	Weightage
Knowledge/Remember	(Define /list /state) type.	15marks
Comprehension	(Classify, describe, discuss, identify, explain, report) type	30marks
Application	(Solve, Sketch, interpret) type. Sums & Mechanisms	20marks
Analysis	(Differentiate, distinguish, Compare) type.	15marks
Evaluation	Argue, Defend, judge,	10marks
Create	Derive, Design, construct, Develop, formulate, investigate	

MODEL PAPER B.Sc., DEGREE EXAMINATION PAPER-C2 SEMESTER-V/VI
CHE(H)- SEC-C2 ENVIRONMENTAL CHEMISTRY

Time: 3hours Maximum Marks:75

PART-A

Answer any FIVE of the following questions. Each carry FIVE markS 5X5=25 Marks

1.Explain about renewable and non-renewable resources.
2.Explain about segments of environment.
3.Explain about formation and depletion of ozone.
4.Explain about controlling methods of air pollution.
5.Explainabout industrial waste water treatment.
6. Explain the toxic effect of arsenic and cadmium.
7. Explain about functions and types of Ecosystem.
8. Write short notes on food chin and food web.

PART-B

Answer ALL the questions. Each carry TEN marks 5X10=50Marks

9 (a). Explain about importance and nomenclature of environmental chemistry?

(Or)

(b)Explain about atmospheric oxygen and Hydrological cycle?

10.(a).Explain about air pollution.?

(Or)

(b)Explain the following

(i)Acid rain (ii) Greenhouse effect?

11.(a).Explain physical and chemical properties of water

(or)

(b)Explain about the methods to convert permanent hard water into soft water?

12.(a).Explain about toxicity effects of lead and mercury.

Or

(b) Explain about toxicity effects of cyanide and pesticides?

13.(a)Describe about bio chemical cycle of nitrogen and phosphorus?

Or

(b)Explain about Biodiversity?

DEPARTMENT OF CHEMISTRY

DR. V. S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM

SEMESTER V (w.e.f. Academic Year 2022-2023)

CHE (H)-Skill Enhancement Course (SEC)D1: SYNTHETIC ORGANIC CHEMISTRY

Total Credits: 05 (Theory-04, Practical-01) (Lectures: Theory- 60, Practical-30)

I. Learning Outcomes:

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

1. Identify the importance of reagents used in the synthesis of organic compounds.
2. Acquire knowledge on basic concepts indifferent types of pericyclic reactions.
4. Understand the importance of retro synthesis in organic chemistry.
5. Comprehend the applications of different reactions in synthetic organic chemistry.

***II.* Syllabus :** *(Total Hours: 90 including Teaching, Lab, Field Skills Training, MODULE tests etc.)*

MODULE-1: Peri cyclic reactions -12 hours

1. A brief introduction to synthetic organic chemistry
2. Features and classification of per cyclic reactions: Phases, nodes and symmetry properties of molecular orbital's in ethylene, 1, 3-butadiene, 1, 3, 5-hexatriene, alkylation and ally radical. Thermal and photochemical reactions.
3. Electro cyclic reactions: Definition and examples, definitions of con and dis rotation, Woodward-Hoffmann selection rules.(Correlation diagrams are not required)
4. Cyclo addition reactions: Definition and examples, definitions of supra facial and an tar facial addition, Woodward- Hoffmann selection rules. (Correlation diagrams are not required)

MODULE-2: Organic photochemistry- 12hours

1. Jablonski diagram-singlet and triplettates
2. PhotochemistryofCarbonylcompounds-$n-\pi$and$\pi-\pi^*$transitions,Norrishtype-1and type-2 reactions
3. Paterno – Buchi reaction.

MODULE-3: Retro synthesis 12 hours

1. Important terms in Retro synthesis with examples-Disconnection, Target molecule, FGI, Synthon, Retro synthetic analysis, chemo selectivity, region selectivity
2. Importance of Order of events in organic synthesis
3. Retro synthetic analysis of the compounds: a. cyclohexene, b.4-Nitro toluene, c. Paracetamol.

MODULE-4: Synthetic Reactions -12hours

Shapiro reaction, Stork - enamine reaction (only alkylation), Wittig reaction, Robinson annulation, Bailys-Hillman reaction, Heck reaction, Suzuki coupling. Synthesis of aldehydes and ketones using1, 3-Dithiane.

MODULE-5: Reagents in Organic Chemistry -12 hours

Oxidizing agents: PCC, PDC, SeO_2 (Riley oxidation), NBS.

Reducing agents: $LiAlH_4$ (with mechanism), LTBA, Metal-solvent reduction (Birch reduction), Catalytic reduction.

III. References

1. Peri cyclic reactions by Ian Fleming, Second edition, Oxford University press.
2. Peri cyclic Reactions-A Text book: Reactions, Applications and Theory by S.Sankararaman, WILEY-VCH.
3. Reaction Mechanismin Organic Chemistry by S.M. Mukherji and S.P.Singh, Revised edition, Trinity Press.

4. Pericyclic reactions-A Mechanistic study by S.M.Mukherji, Macmill an India.
5. Organic synthesis: The disconnection approach by Stuart Warren, John Wiley & Sons.
6. Organic chemistry by Jonathan Clayden, Nick Greeves and Stuart Warren, Second edition, Oxford university press.
7.Reactions, Reagents and Rearrangements by S.N. Sanyal, Bharati Bhawan Publishers & Distributors.***Course6-A*: Synthetic Organic Chemistry-PRACTICAL SYLLABUS**

IV. Learning Outcomes:

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

1. Perform the organic qualitative analysis for the detection of N, S and halogens using the green procedure.
2. Learn the procedure for the separation of mixture famine acids using paper Chromatography.
3. Prepare the TLC plates for TLC chromatography.
4. Acquire skills in conducting column chromatography for the separation of dyes in the given mixture.

V. Practical (Laboratory) Syllabus :(30hrs) (Max.50 Marks)

1. Green procedure for organic qualitative analysis: Detection of N, S and halogens
2. Separation of given mixture of amino acids (glycine and phenyl alanine) using ascending paper chromatography.
3. Separation of a given dye mixture (methyl orange and methylene blue) using TLC (using alumina as adsorbent).
4. Separation of mixture of methyl range and methyl enable by column chromatography
5. Separation of food dyes using Column Chromatography
6. Separation of triglycerides using TLC

VI. Lab References:

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 Aggarwal R. Comprehensive Practical Organic Chemistry, University press.
4. Mann F. G and Saunders B.C, Practical Organic Chemistry, Pearson Education.

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CHE(H)- SEC- D1: SYNTHETIC ORGANIC CHEMISTRY

The Semester question paper consists of 2 sections.

PART-A: Consists of EIGHT short answer questions carries 5 marks out of which 5 are to be answered.

PART- B: Consists of FIVE internal choice essay questions. Each question carries 10 marks. The examiner has to choose 2 questions from each Module

The examiner is requested to set question in such a way that the entire syllabus is reflected in the question paper set by him.

The examiner is requested to give equal importance to easy, moderate and difficult questions.

MODULE	5 MARKS QUESTIONS	QUESTIONSERIALNUMBER	10 MARKSQUESTIONS	QUESTIONSERIAL NUMBER	TOTAL MARKS
1	2	1,2	1(1 OUTOF2 INTERNALCHOICE)	9	20
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4	1	6	1(1 OUTOF2 INTERNALCHOICE)	12	15
5	2	7,8	1(1 OUTOF2 INTERNALCHOICE)	13	20

Weightage for each level of Bloom's Taxonomy		
Bloom's Taxonomy level	Type of question	Weightage
Knowledge/Remember	(Define /list /state) type.	15marks
Comprehension	(Classify, describe, discuss, identify, explain, report) type	30marks
Application	(Solve, Sketch, interpret) type. Sums & Mechanisms	20marks
Analysis	(Differentiate, distinguish, Compare) type.	15marks
Evaluation	Argue, Defend, judge,	10marks
Create	Derive, Design, construct, Develop, formulate, investigate	

MODEL PAPER

B.Sc., DEGREE EXAMINATION SEMESTER-V/VI

CHE(H)- SEC- D1: SYNTHETIC ORGANIC CHEMISTRY

Time:3hours Maximum Marks:75

PART-A

Answer any FIVE of the following questions. Each carries FIVE marks 5X5=25 Marks

1. write a brief note on synthetic organic chemistry.
2. Explain Cyclo addition reactions with examples.
3. Explain Paterno – Buchi reaction with example.
4. Explain Retro synthetic analysis of the cyclohexene.
5. Explain Heck reaction with mechanism.
6. Explain Synthesis of aldehydes ketones using1, 3-Dithiane.
7. Explain the reactions of NBS reagent with examples.
8. Explain Birch reduction with example.

PART-B

Answer ALL the questions. Each carries TEN marks 5X10=50Marks

9. a). Explain Phases, nodes and symmetry properties of molecular orbital's in 1, 3-butadiene.

(OR)

b). Explain Electro cyclic reactions with examples.

10.a).Explain Jablonski diagram of singlet and triplet states.

(OR)

b. Expalin Norrish type-1 and type-2 reactions with examples.

11.a). Explain terms in Retro synthesis with examples.

(OR)

b). Explain Importance of Order of events in organic synthesis.

12.a). Explain Shapiro reaction, Stork - enamine reaction with mechanism.

(OR)

b). Explain Wittig reaction, Robinson annulation with mechanism.

13.a).Explain reactions of PCC and PDC oxidising reagents with example.

(OR)

b). Explain the importance of $LiAlH_4$ in Organic with mechanism.

DEPARTMENT OF CHEMISTRY

DR. V. S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM

SEMESTER V (w.e.f. Academic Year 2022-2023)

CHE (H)-Skill Enhancement Course - SEC- D2: ANALYSIS OF ORGANIC COMPOUNDS

Total Credits: 05 (Theory-04, Practical-01) (Lectures: Theory- 60, Practical-30)

I. Learning Outcomes:

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

1. Identify the importance of mass spectrometry in the structural elucidation of organic compounds.
2. Acquire the knowledge on structural elucidation of organic compounds.
3. Understand various chromatography methods in the separation and identification of organic compounds.
4. Demonstrate the knowledge gained in solvent extraction for the separate the organic compounds.

***II.* Syllabus :** *(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)*

MODULE-1: Mass Spectrometry 12 hours

A brief introduction to analysis of organic compounds

Basic principles, Instrumentation - Mass spectrometer, electron Ionization (Electron Impact ionization, EI), Molecular ions, metastable ions, Isotope abundance. Basic fragmentation types. Fragmentation patterns in Toluene, 2-Butanol, But aldehyde, Propionic acid.

MODULE-2: Structural elucidation of organic compounds using IR, NMR, mass spectral data- 8hours

2, 2, 3, 3-Tetra methyl butane, Butane-2, 3-dione, Prop ionic acid and methyl propionate.

MODULE-3: Structural elucidation of organic compounds using IR, NMR, Mass spectral data- 12 hours

Phenyl acetylene, ace to phenomenon amici acid and p-nitro aniline.

MODULE-4: Separation techniques-1 12 hours

1. Solvent extraction-Principle and theory, Batch extraction technique, application of batch extraction in the separation of organic compounds from mixture- acid & neutral, base &neutral.
2. Chromatography- Principle and theory, classification, types of adsorbents, eluents, Rfvalues and factors affecting Rfvalues.
3. Thin layer chromatography-principle, experimental procedure, advantages and applications.

MODULE-5: Separation techniques- 12 hours

1. Paper chromatography- Principle, experimental procedure, ascending, descending, radial and two dimensional, applications.
2. Column chromatography-Principle, classification, experimental procedure, applications.
3. HPLC-Principle, Instrumentation-block diagram and applications.

III. References

1. Organic Spectroscopy by William Kemp, Third Edition, Palgrave USA.
2. Introduction to Spectroscopy by Pavia, Lamp man, Kriza nd Vyvyan, Fifth edition, Cen gage.
3. Organic Spectroscopy: Principles and Applications by Jag Mohan, Second edition, Alpha Science.
4. Spector's copy of Organic Compounds by P.S.Kalsi, Seventh edition, New Age International.
5. Spectroscopic Methods in Organic Chemistry by Ian Fleming and Dudley Williams, Seventh edition, Springer.
6. Fundamentals of Analytical Chemistry by F.James Holler, Stanley R Crouch, Donald M.Westand Douglas A.Skoog, Ninth edition, Cen gage.
7. Analytical Chemistry by Gary D.Christian, Purnendu K.Dasgupta and Kevin A.Schug, Seventh edition, Wiley.

8. Quantitative analysis by R.A.Day Jr. and A.L.Underwood, Sixth edition, Pearson.
9. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.

Course SEC-D2: Analysis of Organic Compounds - PRACTICAL SYLLABUS

IV. Learning Outcomes:

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

1. Prepare acetanilide using the green synthesis.
2. Demonstrate the preparation of anazodye.
3. Acquire skills in the separation of organic compounds in the given mixture using solvent extraction

V. Practical (Laboratory) Syllabus:(30hrs) (Max.50 Marks)

1. Identification of various equipment in the laboratory.
2. Acetylating of 1o amine by green method: Preparation of acetanilide
3. Rearrangement reaction in green conditions: Benzil - Benzilic acid rearrangement
4. Radical coupling reaction: Preparation of 1,1-bis -2-naphthol
5. Green oxidation reaction: Synthesis of adipic acid
6. Preparation and characterization of biodiesel from vegetable oil/ waste cooking oil
7. Photo reduction of Benzophenone to Benzopinacol in the presence of sunlight.
8. Separation of organic compounds in a mixture (acidic compound + neutral compound) using solvent extraction.
9. Separation of organic compounds in a mixture (basic compound +neutral compound) using solvent extraction.

VI. Lab References:

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 Aggarwal R. Comprehensive Practical Organic Chemistry, University press.
4. Mann F.G and Saunders B.C, Practical Organic Chemistry, Pearson Education.

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CHE(H)- SEC- D2: ANALYSIS OF ORGANIC COMPOUNDS

The Semester question paper consists of 2 sections.

PART-A: Consists of EIGHT short answer questions carries 5 marks out of which 5 are to be answered

PART- B: Consists of FIVE internal choice essay questions. Each question carries 10 marks. The examiner has to choose 2 questions from each Module

The examiner is requested to set question in such a way that the entire syllabus is reflected in the question paper set by him.The examiner is requested to give equal importance to easy, moderate and difficult questions.

MODULE	5 MARKS QUESTIONS	QUESTIONSERIALNUMBER	10 MARKSQUESTIONS	QUESTION SERIAL NUMBER	TOTAL MARKS
1	2	1,2	1(1 OUTOF2 INTERNALCHOICE)	9	20
2	2	3,4	1(1 OUTOF2 INTERNALCHOICE)	10	20
3	1	5	1(1 OUTOF2 INTERNALCHOICE)	11	15
4	2	6,7	1(1 OUTOF2 INTERNALCHOICE)	12	20
5	1	8	1(1 OUTOF2 INTERNALCHOICE)	13	15

Weightage for each level of Bloom's Taxonomy

Bloom's Taxonomy level	Type of question	Weightage
Knowledge/Remember	(Define /list /state) type.	15marks
Comprehension	(Classify, describe, discuss, identify, explain, report) type	30marks
Application	(Solve, Sketch, interpret) type. Sums & Mechanisms	20marks
Analysis	(Differentiate, distinguish, Compare) type.	15marks
Evaluation	Argue, Defend, judge,	10marks
Create	Derive, Design, construct, Develop, formulate, investigate	

MODEL PAPER

B.Sc., DEGREE EXAMINATION SEMESTER-V/VI

CHE(H)- SEC- D2: ANALYSIS OF ORGANIC COMPOUNDS

Time: 3h Maximum Marks: 75

PART-A

Answer any FIVE of the following questions. Each carries FIVE marks 5X5=25 Marks

1.Write about Isotopic abundance in Mass Spectroscopy.

2.Explain the Mass Fragmentation patterns in Propanoic acid.

3.Explain Structural elucidation of methyl propionate using IR, NMR, mass spectra data.

4.Explain Structural elucidation of Propanoic acid using IR, NMR, mass spectra data.

5.Explain Structural elucidation of p-nitro aniline using IR, NMR, mass spectra data.

6. Expalin Batch extraction technique with applications.

7. Explain Thin layer chromatography with examples.

8. Explain Paper chromatography with applications.

PART-B

Answer ALL the questions. Each carries TEN marks 5X10=50Marks

9.a).Explain Basic principles and Instrumentation of Mass spectrometer.

(OR)

b. Explain the Mass Fragmentation patterns in Toluene and 2-Butanol.

10.a).Explain Structural elucidation of 2, 2, 3, 3-Tetra methyl butane using IR, NMR, mass spectra.

(OR)

b).Explain Structural elucidation of Butane-2, 3-dione using IR, NMR, mass spectra.

11.a).Explain Structural elucidation of Phenyl acetylene using IR, NMR, mass spectra.

(OR)

b).Explain Structural elucidation of acetophenone end cinnamic acid using IR, NMR, mass spectra data.

12. a). Explain Principle, applications of Solvent extraction.

(OR)

b). Explain Principle, classification and applications of Chromatography.

13.a). Explain Column chromatography priciple, classification and applications.

(OR)

b). Explain HPLC-Principle, Instrumentation-block diagram and applications.

DEPARTMENT OF CHEMISTRY

DR. V. S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM

SEMESTER V (w.e.f. Academic Year 2022-2023)

CHE (H)-Skill Enhancement Course - SEC- E1: Novel Inorganic Solids

Total Credits: 05 (Theory-04, Practical-01) (Lectures: Theory- 60, Practical-30

Credit: 5 (L 4 – T 0 – P 1) Total Lectures: 90 (Theory – 60; Practical – 30)

Course Objectives

This introductory course intends to make learners familiar with a wide variety of technologically important and emerging materials. It will prepare the learners for studying materials further at the master's level.

Learning Outcomes

After the completion of this course, students will be able to:

1. Learn syntheses of advanced material.
2. Understand the connections between the structure and properties of solids
3. Learn about the theory and methods that can be applied to the development of new materials with particular desired properties and thereby enabling them to opt for studying an interdisciplinary master's programme with an emphasis on the synthesis and applications of various materials.
4. Get introduced to various engineering materials used for mechanical construction.
5. Acquire knowledge in ceramics and refractory materials.
6. Have firsthand experience in synthesizing a few simple conducting polymers.
7. Carry out laboratory synthesis of nanoparticles.

MODULE 1: Inorganic Solids and Pigments

Synthesis and modification of inorganic solids: Conventional heat and beat methods, co-precipitation method, sol-gel methods, hydrothermal method, ion-exchange and intercalation methods.

Inorganic solids of technological importance: Solid electrolytes – cationic, anionic, and mixed.

Inorganic pigments-coloured solids, white and black pigments.

(10 Lectures)

MODULE 2: Advanced Materials

Molecular material and fullerides, molecular materials & chemistry – one-dimensional metals, molecular magnets, inorganic liquid crystals.

Nanomaterials: Overview of nanostructures and nanomaterials; classification.

Preparation of gold and silver metallic nanoparticles, self-assembled nanostructures-control of nano architecture-one dimensional control. Carbon nanotubes and inorganic nanowires. Bio-inorganic nanomaterials, natural and artificial nanomaterials, bio-nanocomposites.

(15 Lectures)

MODULE 3: Engineering Materials

Introduction to engineering materials for mechanical construction: Composition, mechanical and fabricating characteristics and applications of various types of cast irons, plain carbon and alloy steels, copper, aluminium and their alloys like duralumin, brasses and bronzes cutting tool materials, super alloys thermoplastics, thermosets and composite materials.

Composite materials: Introduction, limitations of conventional engineering materials, role of matrix in composites, classification, matrix materials, reinforcements, metal-matrix composites.

(10 Lectures)

MODULE 4: Specialty Polymers and Ceramics

Conducting polymers-Introduction, conduction mechanism, polyacetylene, polyparaphenylene and polypyrrole, applications of conducting polymers. (10 Lectures)

MODULE 5

Polymer-matrix composites, fibre-reinforced composites,
environmental effects on composites, applications of composites.

Ion-exchange resins and their applications.

Ceramic & Refractory: Introduction, classification, properties, raw materials, manufacturing and applications.

(15 Lectures)

PRACTICAL :Novel Inorganic Solids

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1. Synthesis of conducting polymers (polyaniline and polypyrrole).
2. Determination of cation exchange capacity.
3. Determination of total dissolved solids.
4. Synthesis of hydrogel by co-precipitation method.
5. Synthesis of silver and gold metal nanoparticles.

Recommended Books

Theory

1. Atkins, P.; Overton, T.; Rourke, J.; Weller, M.; Armstrong, F., *Shriver & Atkins Inorganic Chemistry*, 5th Ed, Oxford University Press (2011-2012)

2. Kakani, S. L.; Kakani, A., *Material Science*, 3rd Ed., New Age International Publishers, New Delhi (2016).

3. West, A. R., *Solid State Chemistry and its Application*, Wiley India, New Delhi (2007).

4. Smart, L. E.; Moore, E. A., *Solid State Chemistry: An Introduction*, 4th Ed., CRC Press, New Delhi (2017).

5. Poole, C. P. Jr.; Owens, F. J., *Introduction to Nanotechnology*, Wiley India, New Delhi (2007). 1. Ahluwalia, V. K.; Aggarwal, R., *Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis*, Universities Press (2000).

Practical

Ahluwalia, V. K.; Aggarwal, R., *Comprehensive Practical Organic Chemistry: Preparation and Quantitative Analysis*, Universities Press (2000).

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CHE (H)-Skill Enhancement Course

SEC- E1: Novel Inorganic Solids

The Semester question paper consists of 2 sections.

PART-A: Consists of EIGHT short answer questions carries 5 marks out of which 5 are to be answered.

PART- B: Consists of FIVE internal choice essay questions. Each question carries 10 marks .

The examiner has to choose 2 question from each Module

The examiner is requested to set question in such a way that the entire syllabus is reflected in the question paper set by him.

The examiner is requested to give equal importance to easy, moderate and difficult questions..

MODULE	5 MARKS QUESTIONS	QUESTION SERIAL NUMBER	10 MARKS QUESTIONS	QUESTION SERIAL NUMBER	TOTAL MARKS
1	2	1 ,2	1 (1 OUT OF 2 INTERNAL CHOICE)	9	20
2	2	3 ,4	1 (1 OUT OF 2 INTERNAL CHOICE)	10	20
3	2	5, 6	1 (1 OUT OF 2 INTERNAL CHOICE)	11	20
4	1	7	1 (1 OUT OF 2 INTERNAL CHOICE)	12	15
5	1	8	1 (1 OUT OF 2 INTERNAL CHOICE)	13	15

Weightage for each level of Bloom's Taxonomy		
Bloom's Taxonomy level	**Type of question**	**Weightage**
Knowledge /Remember	(Define/ list /state) type.	15 marks
Comprehension/ Understand	(Classify, describe, discuss, identify, explain, report) type	30 marks
Application	(Solve, Sketch, interpret) type. Sums & Mechanisms	20 marks
Analysis	(Differentiate, distinguish, Compare) type.	15 marks
Evaluation	Argue, Defend, judge,	10marks
Create	Derive, Design, construct, Develop, formulate, investigate	

DEPARTMENT OF CHEMISTRY

DR. V. S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM

SEMESTER V- CHE (H)-Skill Enhancement Course SEC- E1: Novel Inorganic Solids

(w.e.f. Academic Year 2022-2023)

Time: 3 hours Maximum Marks: 75

PART- A

Answer any FIVE of the following questions. Each carries FIVE marks 5 X 5 = 25 Marks

1 State about solid-state electrolytes
2 Write a note on. Inorganic pigments
3 Write a note on bioinorganic nanoparticles.
4 Explain about one-dimensional Metal
5 Discuss the Alloys of brass and bronze
6 State about Matrix materials and the reinforcement material.
7 Explain conducting polymers.
8 write a note on applications of composites

PART- B

Answer ALL the questions. Each carries TEN marks 5 X 10 = 50 Marks

9 (a). Explain the Synthesis of inorganic solids by sol-gel Method and hydrothermal method.

(or)

(b). Explain the synthesis of inorganic solids by ion exchange and the Copercipitation method.

10 (a) Discuss about the fullerides

(or)

(b) Explain the preparation of silver and gold nanoparticles.

11(a) Discuss Composition. Mechanical and fabricating characteristics of Cast Iron and Steel

(or)

(b). Define composite material and its classification. Write about role of Matrix in composites

12.(a). Described conduction mechanism of conducting polymer polyacetylene .

(or)

(b)Described conduction mechanism of conducting polymer polypyrrole

13.(a). Define ceramics. Discuss about the polymer Matrix composites.

(or)

b) Define refractory. Describe about the fiber reinforced composites

DEPARTMENT OF CHEMISTRY

DR. V. S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM

SEMESTER V -CHE (H)-Skill Enhancement Course – (SEC)

E2: Applications of Computers in Chemistry

Total Credits: 05 (Theory-04, Practical-01) (Lectures: Theory- 60, Practical-30

Credit: 5 (L 4 – T 0 – P 1) Total Lectures: 90 (Theory – 60; Practical – 30)

Course Objectives

This course intends to make learners familiar with basics of computer language, computer programming, and handling of experimental data, curve fitting, etc. to analyse experimental results. This basic knowledge will help the students to perform and interpret results of various chemistry practicals.

Learning Outcomes

On completion of this course, students will be able to:

1. Review the basics of computer, bits, bytes, binary & ASCII formats, etc.
2. Have a glimpse on various numerical methods and mathematics pertaining to computers.
3. Get introduced to the elementary idea of molecular modelling.
4. Do simple numerical using computers.

MODULE 1: Basics of Computers

Basics: Constants, variables, bits, bytes, binary and ASCII formats, arithmetic expressions, hierarchy of operations, inbuilt functions. Elements of the BASIC language. BASIC keywords and commands. Logical and relative operators. Strings and graphics. Compiled versus interpreted languages. Debugging. Simple programs using these concepts.

(10 Lectures)

MODULE 2: Numerical Methods I

Matrix addition and multiplication. Statistical analysis.

Roots of equations: Numerical methods for roots of equations: Quadratic formula, iterative method, Newton-Raphson method, Binary bisection and Regula-Falsi. (10 Lectures)

MODULE 3: Numerical Methods II

Differential calculus: Numerical differentiation.

(15 Lectures)

Integral calculus: Numerical integration (Trapezoidal and Simpson's rule), probability distributions and mean values.

MODULE 4: Simultaneous equations

Simultaneous equations: Matrix manipulation: addition, multiplication. Gauss-Siedal method. Interpolation, extrapolation and curve fitting: Handling of experimental data.

(10 Lectures)

MODULE 5: Molecular Modelling

Conceptual background of molecular modelling: Potential energy surfaces. Elementary ideas of molecular mechanics and practical MO methods.

(15 Lectures)

PRACTICAL - Applications of Computers in Chemistry

1. Computer programs based on numerical methods for roots of equations: (e.g., volume of van der Waals gas and comparison with ideal gas, pH of a weak acid).
2. Numerical differentiation (e.g., change in pressure for small change in volume of a van der Waals gas, potentiometric titrations).
3. Numerical integration (e.g., entropy/ enthalpy changes from heat capacity data), probability distributions (gas kinetic theory) and mean values.
4. Matrix operations. Application of Gauss-Siedel method in colourimetry.
5. Simple exercises using molecular visualization software.

Recommended Books

Theory

1. Jansen, F. A., Introduction to Computational Chemistry, 2nd Ed., Wiley (2007).
2. Balagurusamy, E., *Numerical Methods*, Tata McGraw Hill, New Delhi (1999).
3. Noggle, J. H., *Physical Chemistry on a Microcomputer*, Little Brown & Co. (1985).
4. Venit, S. M., *Programming in BASIC: Problem Solving with Structure and Style*. Jaico Publishing House: Delhi (1996).

Practical

1. Balagurusamy, E., *Numerical Methods*, Tata McGraw Hill, New Delhi (1999).
2. McQuarrie, D. A., *Mathematics for Physical Chemistry*, University Science Books (2008).
3. Mortimer, R., *Mathematics for Physical Chemistry*. 3rd Ed., Elsevier (2005).
4. Yates, P., *Chemical Calculations*, 2nd Ed. CRC Press (2007).
5. Venit, S. M. *Programming in BASIC: Problem solving with structure and style*, Jaico Publishing House, Delhi (1996).

BLUE PRINT

SEC- E2: Applications of Computers in Chemistry

The Semester question paper consists of 2 sections.

PART-A: Consists of EIGHT short answer questions carries 5 marks out of which 5 are to be answered.

PART- B: Consists of FIVE internal choice essay questions. Each question carries 10 marks .

The examiner has to choose 2 question from each Module

The examiner is requested to set question in such a way that the entire syllabus is reflected in the question paper set by him.

The examiner is requested to give equal importance to easy, moderate and difficult questions..

MODULE	5 MARKS QUESTIONS	QUESTION SERIAL NUMBER	10 MARKS QUESTIONS	QUESTION SERIAL NUMBER	TOTAL MARKS
1	2	1 ,2	1 (1 OUT OF 2 INTERNAL CHOICE)	9	20
2	2	3 ,4	1 (1 OUT OF 2 INTERNAL CHOICE)	10	20
3	1	5	1 (1 OUT OF 2 INTERNAL CHOICE)	11	15
4	1	6	1 (1 OUT OF 2 INTERNAL CHOICE)	12	15
5	2	7, 8	1 (1 OUT OF 2 INTERNAL CHOICE)	13	20

Weightage for each level of Bloom's Taxonomy

Bloom's Taxonomy level	Type of question	Weightage
Knowledge /Remember	(Define/ list /state) type.	15 marks
Comprehension/ Understand	(Classify, describe, discuss, identify, explain, report) type	30 marks
Application	(Solve, Sketch, interpret) type. Sums & Mechanisms	20 marks
Analysis	(Differentiate, distinguish, Compare) type.	15 marks
Evaluation	Argue, Defend, judge,	10marks
Create	Derive, Design, construct, Develop, formulate, investigate	

DEPARTMENT OF CHEMISTRY
DR. V. S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM
SEMESTER V - CHE (H)-Skill Enhancement Course
SEC- E2: Applications of Computers in Chemistry
(w.e.f. Academic Year 2022-2023)

Time: 3 hours Maximum Marks: 75

PART- A

Answer any **FIVE** of the following questions. Each carries **FIVE** marks 5 X 5 = 25 Marks

1. Explain the terms constant and variables.
2. Explain the terms arthematic expressions and inbuild functions.
3. Write a brief note on matrix addition
4. Describe about matrix multiplication.
5. State probability distributions in numerical integration.
6. Explain numerical integration by Trapezoidal rule
7. Write a note on interpolation.
8. State about molecular modelling.

PART- B

Answer **ALL** the questions. Each carries **TEN** marks 5 X 10 = 50 Marks

9 (a). Discuss on elements of BASIC LANGUAGE, BASIC keywords and commands.

(or)

(b). Discuss about logical and relative operators in BASIC LANGUAGE.

10(a). Explain the numerical method for roots of equation by iterative method

(or)

(b). Explain the numerical method for roots of equation by Newton - Raphson method

11.(a).Describe Numerical differenctial with suitable Example.

(or)

(b). Discuss the numerical integration by Simpsons rule

12.(a). Analyse about the matrix manipulation

(or)

(b). Discuss the handling of experimental data by extrapolation and curve fitting.

13.(a). Explain Elementary ideas of molecular mechanics

(or)

(b) Discuss about potential energy surfaces.

DEPARTMENT OF CHEMISTRY

DR. V. S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM

SEMESTER V - CHE (H)-Skill Enhancement Course

SEC- F1: INDUSTRIAL CHEMISTRY-1 (w.e.f. Academic Year 2022-2023)

Total Credits: 05 (Theory-04, Practical-01) (Lectures: Theory- 60, Practical-30)

I. Learning Outcomes:

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

1. Identify the importance of different surface coatings.
2. Acquire a critical knowledge on manufacture of ceramics and cement.
3. Understand various steps in the manufacture of cane sugar.
4. Explain the manufacture of pulp and paper.

***II.* Syllabus :** *(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)*

MODULE-1: Fertilizers 10 hours

A brief introduction to industrial chemistry

Different types of fertilizers. Manufacture of the following fertilizers: Urea, Ammonium nitrate, Calcium ammonium nitrate, Ammonium phosphates; Polyphosphate, Superphosphate, Compound and mixed fertilizers.

MODULE-2: Silicates 10hours

1. **Ceramics:** Important clays and Felds par. Ceramics-types, uses and manufacture. High technology ceramics and their applications.
2. **Cements:** Classification of cement, ingredients and their role, Manufacture of cement and the setting process, quick setting cements.

MODULE-3: Surface Coatings 12 hours

Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Oil paint, modified oils, Pigments, toners and lake pigments, fillers, thinners, enamels, emulsifying agents. Special paints (Heat retardant, Fire retardant, Eco-friendly paint, Plastic paint), Water and Oil paints.

MODULE-4: Sugar Chemistry 08hours

Introduction–Manufacture and recovery of cane sugar from molasses, manufacture of sucrose from beat root, testing and estimation of sucrose.

MODULE-5: Paper Industry 10hours

Pulp and Paper-Introduction, Manufacture of pulp, sulphate or Kraft pulp, soda pulp, sulphite pulp, rag pulp, beating, refining, filling, sizing and colouring of pulp, manufacture of paper.

III. References:

1. E.Stocchi: *Industrial Chemistry*, Vol-I, Ellis HorwoodLtd.UK
2. J.A.Kent: Riegel's *Hand book of Industrial Chemistry*, CBS Publishers, New Delhi.
3. P.C.Jain, M.Jain: *Engineering Chemistry,* Dhanpat Rai & Sons, Delhi.
4. R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry,* Vikas Publications, NewDelhi.
5. B.K.Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut
6. O. P. Vermani, A. K. Narula: *Industrial Chemistry,* Galgotia Publications Pvt. Ltd., New Delhi.

***Course6 C*: Industrial Chemistry-1- PRACTICAL SYLLABUS**

IV. Lab work-Skills Outcomes:

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

1. Determine free acidity in ammonium sulphate fertilizer.
2. Learn the procedure for the Estimation of Calcium in Calcium ammonium nitrate fertilizer.

3. Demonstrate skills on Estimation of phosphoric acid in superphosphate fertilizer.
4. Acquire skills in using colorimetry for the estimation of sucrose.

V. Practical(Laboratory)Syllabus:(30hrs) (Max.50 Marks)

1. Determination of free acidity in ammonium sulphate fertilizer.
2. Estimation of Calcium in Calcium ammonium nitrate fertilizer.
3. Estimation of phosphoric acid in superphosphate fertilizer.
4. Estimation of sucrose by colorimetry.

VI: Lab References

1. Text book of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
2. Text book on Experiments and Calculations in Engineering Chemistry, S.S.Dara, S.Chand.
3. R.Gopalan, D.Venkappayya, S.Nagarajan: Engineering Chemistry, Vikas Publications.
4. B.K.Sharma: Engineering Chemistry, Goel Publishing House, Meerut

INDUSTRIAL CHEMISTRY -I- BLUE PRINT

Important Tips for Setting Question Paper

1. The examiner is requested to set question in such a way that the entire syllabus is reflected in the question paper set by him.
2. It is suggested that the question writer should use his/her judgment in assigning difficulty value to each question. Following scale should guide you to set questions at different difficulty levels and use the **Bloom's Taxonomy** action verbs given below.

Bloom's Level	Remembering	Understanding	Applying	Analyzing	Evaluating	Creating
% of Weightage	30	20	20	15	10	5

Question Paper Pattern

The Semester question paper consists of 2 sections.
PART-A: Consists of **EIGHT** short answer questions carries **5** marks out of which **5** are to be answered..PART- B: Consists of **FIVE** internal choice essay questions. Each question carries **10** marks.

1. The examiner has to choose **2**questions from each module.

SI. No	Modules	Name of the Module	5 M Questions	Question Serial Number	10 M Questions	Question Serial Number	Weightage per Module
1	Module 1	**Fertilizers**	2	1, 2	2	9 (a) or 9 (b)	20 Marks
2	Module 2	**Silicates**	2	3, 4	2	10 (a) or 10 (b)	20 Marks
3	Module 3	**Surface Coatings**	1	5	2	11 (a) or 11 (b)	15 Marks
4	Module 4	**Sugar Chemistry**	2	6, 7	2	12 (a) or 12 (b)	20 Marks
5	Module 5	**Paper Industry**	1	8	2	13 (a) or 13 (b)	15 Marks

INDUSTRIAL CHEMISTRY- I

MODEL PAPER

SECTION -- A

Answer any **FIVE** questions from the following. 5 X 5 = 25 M

1. Explain compound fertilizers with examples.
2. Give the composition of the superphosphate of lime.
3. Write the composition and uses of feldspar.
4. Explain the setting process of cement.
5. Define thinners and enamels with examples.
6. Describe the tests for the estimation of sucrose.
7. Write the systematic flow diagram for the manufacture of sugar.
8. Discuss the terms filling and sizing in the paper industry.

SECTION -- B

Answer ALL the following questions. 5 X 10 = 50 M

9. (a) Explain briefly the classification of fertilizers.

(Or)

(b) Explain the process of industrial manufacture of ammonium nitrate.

10. (a) Explain high technology ceramics with their applications.

(Or)

(b) Explain the manufacture of cement.

11. (a) Write the objectives of surface coatings.

(Or)

(b) Discuss briefly eco paints and plastic paints.

12. (a) Explain the industrial process of manufacturing of sugar from molasses.

(Or)

(b) Explain the industrial process of preparation of sucrose from beetroot.

13. (a) Give the preparation fo kraft pulp and sulphate pulp.

(Or)

(c) Write the different steps involved in preparation of paper in paper industry.

DEPARTMENT OF CHEMISTRY

DR. V. S. KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM

SEMESTER V (w.e.f. Academic Year 2022-2023)

CHE (H)-Skill Enhancement Course - SEC- F2: INDUSTRIAL CHEMISTRY-2

Learning Outcomes:

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

1. Identify the importance of industrial waste management.
2. Acquire a critical knowledge on the preparation and applications of organic polymers.
3. Demonstrate the analysis of water quality parameters.
4. Explain the sources of air pollution.

II.* Syllabus :(Total Hours: 90 including Teaching, Lab, Field Skills Training, Unit tests etc.)*

Unit-1: Organic Polymers-1 10 hours

Basic definitions, degree of polymerization, classification of polymers- Natural and Synthetic polymers, Organic and In organic polymers, Thermoplastic and Thermo setting polymers, Plastics, Elastomers, Fibers and Resins, Linear, Branched and Cross-Linked polymers.

Unit-2: Organic Polymers-2 10 hours

Addition polymers and Condensation polymers, mechanism of polymerization- Free radical, ionic and Zeigler-Natta polymerization. Industrial manufacturing and applications of following polymers, Polystyrene, Poly acrylonitrile, Poly methacrylate, Poly methyl-methacrylate.

Unit-3: Air Pollution 8 hours

Sources of air pollution, acid rain, photochemical smog, Greenhouse effect, Formation and depletion of ozone, sources and effects of various gaseous pollutants: NOx, SOx, SPM, CO, hydrocarbons, controlling methods of air pollution.

Unit-4: Analysis of water 10hours

Determination of total hardness of water, Dissolved oxygen, BOD, COD, total dissolved solids, turbidity, alkalinity, determination of chloride using Mohr's method.

Unit-5: Industrial Waste Management 12hours

Waste water treatment - primary, secondary & tertiary treatment. (All treatment methods in detail). Characteristics of solid wastes, methods of solid waste treatment and disposal, microbiology involved in solid waste disposal, methods of solid waste disposal-composting, sanitary landfilling- economic, aesthetic and environmental problems.

III. References:

1. E.Stocchi: *IndustrialChemistry*,Vol-I,EllisHorwoodLtd.UK
2. J.A.Kent: Riegel's *Handbook of Industrial Chemistry*, CBS Publishers, New Delhi.
3. P.C.Jain, M.Jain: *Engineering Chemistry,* DhanpatRai & Sons, Delhi.
4. R. Gopalan, D. Venkappayya, S. Nagarajan: *Engineering Chemistry,* Vikas Publications, New Delhi.
5. B.K.Sharma: *Engineering Chemistry*, Goel Publishing House, Meerut
6. O. P. Vermani, A. K. Narula: *Industrial Chemistry,* Galgotia Publications Pvt. Ltd., New Delhi.
7. A.K.De, *Environmental Chemistry*: New Age International Pvt, Ltd, New Delhi.
8. C.k.Varshney: *Water Pollution and Management*, Wiley Eastern Limited, Chennai.
9. S.S. Dara and D.D. Mishra: *Textbook of Environmental Chemistry and Pollution Control*, Revised edition, S.C.Hand &CoLtd.

Industrial Chemistry-2-PRACTICAL SYLLABUS

IV. Lab work-Skills Outcomes:

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

1. Learn the procedures for the determination of BOD and COD.

2. Demonstrate skills in the determination of chloride in the given water sample.
3. Acquire skills in determining the hardness of water.

V. Practical (Laboratory) Syllabus:(30hrs) (Max.50 Marks)

1. Determination of Hardness of water by EDTA titration.
2. Determination of Chemical Oxygen Demand (COD)
3. Determination of Biological Oxygen Demand (BOD)
4. Determination of chloride using Mohr's method.
5. Determination of pH, turbidity and total solids in water sample.
6. Determination of Ca^{+2} and Mg^{+2} in soil sample by flame photometry.
7. Determination of Ph in soil samples using pH metry.

VI. Lab References:

1. Textbook of Vogel's Quantitative Chemical Analysis, Sixth edition, Pearson.
2. Textbook on Experiments and Calculations in Engineering Chemistry, S.S.Dara, S.Chand.

INDUSTRIAL CHEMISTRY II

BLUE PRINT

Important Tips for Setting Question Paper

1. The examiner is requested to set question in such a way that the entire syllabus is reflected in the question paper set by him.
2. It is suggested that the question writer should use his/her judgment in assigning difficulty value to each question. Following scale should guide you to set questions at different difficulty levels and use the **Bloom's Taxonomy** action verbs given below.

Bloom's Level	Rememberin g	Understanding	Applying	Analyzing	Evaluating	Creating
% of Weightage	30	20	20	15	10	5

Question Paper Pattern

1. The Semester question paper consists of 2 sections.

   PART-A: Consists of **EIGHT** short answer questions carries **5** marks out of

   which **5** are to be answered.

   PART- B: Consists of **FIVE** internal choice essay questions. Each question carries **10** marks.

1. The examiner has to choose 2questions from each module.

Sl. No	Modules	Name of the Module	5 M Questions	Question Serial Number	10 M Questions	Question Serial Number	Weightage per Module
1	Module 1	Organic polymers 1	2	1, 2	2	9 (a) or 9 (b)	20 Marks
2	Module 2	Organic polymers 2	2	3, 4	2	10 (a) or 10 (b)	20 Marks
3	Module 3	Air pollution	1	5	2	11 (a) or 11 (b)	15 Marks
4	Module 4	Analysis of water	2	6, 7	2	12 (a) or 12 (b)	20 Marks
5	Module 5	Industrial waste management	1	8	2	13 (a) or 13 (b)	15 Marks

INDUSTRIAL CHEMISTRY II

MODEL PAPER

SECTION -- A

Answer any **FIVE** questions from the following. 5 X 5 = 25 M

1. Explain degree of polymerisation.
2. Write the differences between thermo setting and thermo plastic polymers.
3. Write about condensation polymers.
4. Give the preparation of acrylo nitrile.
5. Write a note on greenhouse effect.
6. Define COD and BOD.
7. Explain the pollution effect by Nitrogen oxides.
8. Explain classification solid wate.

SECTION -- B

Answer ALL the following questions. 5 X 10 = 50 M

9. (a) Discuss briefly the classification of polymers.

(Or)

(b) Explain linear and branched chain polymerization processes.

10. (a) Explain Zeigler Natta`s catalysis.

(Or)

(b) Explain the mechanism ionic and free radical polymerization.

11. (a) Explain (i) photochemical smog (ii) Depletion of ozone layers.

(Or)

(b) Discuss effect of different air pollutants.

12. (a) Explain hardness of water. Explain methods to remove hardness of water.

(Or)

(b) Write the experimental methods to determine the cloride and alkalinity in water.

13. (a) Explain different steps involved in wate water treatment process.

(Or)

(b) Explain the solid waste management briefly.

DEPARTMENT OF CHEMISTRY
DR. V. S KRISHNA GOVT. DEGREE COLLEGE (A), VISAKHAPATNAM
SEMESTER 1I –MINOR CHEMISTRY-I
INORGANIC AND GENERAL CHEMISTRY for B.Sc (PHYSICS)

Course I (Inorganic & General Chemistry) **60 hrs. (4h/w)**

Course Objectives

This course mainly reviews the basic concepts of chemistry.

CO1. It discusses structure of atoms,

CO2. Periodic properties of elements (*s*- and *p*- block elements) elaborately.

CO3. Provides basic knowledge of chemical bonding (ionic and covalent)

CO4. Introduces weak chemical forces

CO5. Various Acid – Base theories

Learning Outcomes

On completion of this course the students will be able to:

LO1. Understand quantum mechanical model of atom, quantum numbers

LO2. Long form of periodic Table, Periodic properties

LO3. Understand the theories of metallic bond. Weak forces of interaction

LO4. Deduce the geometry of molecules using radius ratio rules & VSEPR theory.

LO5. Complete knowledge of Acids and Bases

SYLLABUS

MODULE I: Periodicity of Elements **15hrs**

The long form of periodic table. *s*, *p*, *d* and *f*-block elements. Periodic properties of the elements,with reference to s- and p-block.

(a) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table.

(b) Atomic radii (van der Waals)

(c) Ionic and crystal radii.

(d) Covalent radii (octahedral and tetrahedral)

(e) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy.

(f) Electronegativity, electronegativity scales (Pauling, Mülliken, Allred Rachow). Variation of electronegativity with bond order, partial charge, hybridization

Electronic Configuration and General Characteristics of *d* and *f*-block elements

MODULE II: Atomic Structure **10hrs**

Bohr's theory and its limitations, atomic spectrum of hydrogen atom. Wave mechanics: de Broglie equation, Heisenberg's Uncertainty Principle and its significance, Schrödinger's wave equation, significance of ψ and $\psi 2$. Quantum numbers and their significance. Normalized and orthogonal wave functions. Sign of wave functions. Radial and angular wave functions for hydrogen atom. Radial and angular distribution curves. Shapes of *s*, *p*, *d* and *f* orbitals.

MODULE III: Metallic Bonding and Weak Chemical forces **10hrs**

Metallic bond: Valence bond theory of metals, Band theory, Conductors, Semiconductors, Insulators. Qualitative idea of free electron theory.

Weak chemical forces: Vander Waals forces, ion-dipole, dipole-dipole, dipole-induced dipole interactions. H-bonding and its types, effect of intra and inter molecular hydrogen bonding on physical properties of molecules like melting and boiling points, solubility.

MODULE IV: Chemical Bonding **15hrs**

Ionic bond: General characteristics of ionic bonding. Energy considerations in ionic bonding, lattice energy and solvation energy- their importance in the context of stability and solubility of ionic compounds. Lattice energy, Born-Haber cycle and its applications, polarizing power and polarizability. Fajan's rules, ionic character in covalent compounds, bond moment, dipole moment and percentage ionic character.

Covalent bond: Characteristics and properties, valence bond theory. Application of hybridisation (sp, sp2, sp3, dsp3 and d2sp3) to explain structure of simple molecules. Bent's rule, resonance and resonance energy. Polarity in covalent molecules, dipole moment, percentage ionic character and electro negativity difference. Valence shell electron pair repulsion theory **(VSEPR),** shapes of simple molecules and ions containing lone pairs and bond pairs of electrons, multiple bonding (σ and π bond approach) and bond lengths.

MODULE V: Acid-Base Chemistry **10hrs**

Arrhenius Acid Base theory, Brönsted-Lowry theory of acids and bases and Lewis concepts of acids and bases, Proton transfer equilibria in water, solvent levelling, Classification of acids and bases as hard and soft. Pearson's HSAB concept, classification of hard and soft acid, bases. Theoretical basis of hardness and softness, Applications HSAB.

Reference Books:

1. Lee, J. D., *Concise Inorganic Chemistry*, 5th Ed., Wiley India (2008).
2. Housecroft, C. E; Sharpe, A. G., *Inorganic Chemistry*, 5th Ed., Pearson Education (2018).
3. Atkins, P.; Overton, T.; Rouke, J.; Weller, M.; Armstrong, F.; Hagerman, M., *Shriver Atkins's Inorganic Chemistry*, 6th Ed., Oxford University Press India (2015).
4. Miessler, G.; Tarr, D. A., *Inorganic Chemistry*, 3rd Ed., Pearson Education India (2008).
5. Huheey, J. E.; Keiter, E. A.; Keiter, R. L.; Medhi, O. K., *Inorganic Chemistry: Principles of Structures and Reactivity*, 4th Ed., Pearson Education India (2006).
6. Cotton, F. A.; Wilkinson, G.; Gaus, P. L., *Basic Inorganic Chemistry*, 3rd Ed., Wiley India (2007).
7. Puri, B. R.; Sharma, L. R.; Kalia, K. C., *Principles of Inorganic Chemistry*, 33rd Ed., Vishal Publishing (2017).
8. Advanced Inorganic Chemistry - Vol. I & II, by Satya Prakash, Dr G.D Tuli, Dr S.K.Basu, Dr R D Madan

LABORATORY COURSE- Minor Chemistry-I **30hrs (2 h / w)**

Practical-I Volumetric Analysis

(At the end of Semester-II)

Course outcomes:

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

1. Use glassware, equipment and chemicals and follow experimental procedures in the laboratory
2. Understand the volumetric analysis based on fundamental concepts
3. Learn and identify the concepts of standard solutions, primary and secondary standards
4. Facilitates the learner to make solutions of various molar concentrations.

This may include: The concept of the mole; Converting moles to grams; Converting grams to moles; Defining concentration; Dilution of Solutions; Making different molar concentrations.

Volumetric analysis **50 M**

1. Estimation of sodium carbonate and sodium hydrogen carbonate present in a mixture.
2. Determination of Fe (II) using $KMnO_4$ with oxalic acid as primary standard.
3. Determination of Cu (II) using $Na_2S_2O_3$ with $K_2Cr_2O_7$ as primary standard.
4. Estimation of water of crystallization in Mohr's salt by titrating with $KMnO_4$

Reference Books:

1. Raj, G., *Advanced Practical Inorganic Chemistry*, Krishna Prakashan, Meerut, Meerut (2013).
2. Mendham, J.; Denney, R. C., Barnes, J. D.; Thomas, M.; Sivasankar, B., *Vogel's Quantitative Chemical Analysis*, 6th Ed., Pearson Education India (2009).

SEMESTER 1I –MINOR CHEMISTRY-I

INORGANIC AND GENERAL CHEMISTRY for B.Sc (PHYSICS HONOURS)

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TIME: 3 Hrs Max.Marks: 75

S.No.	UNIT	Name of the Chapter	Essay Questions (10 M)	Short Answer Questions (5 M)
1	UNIT-I	Periodicity of Elements	2	2
2	UNIT-II	Atomic Structure	2	1
3	UNIT-III	Metallic bond	1	1
		Weak chemical forces	1	1
4	UNIT-IV	Ionic bond	1	1
		Covalent Bond	1	1
5	UNIT-V	Acid-Base Chemistry	2	1

PROGRAM OUTCOMES

PO 1: Understand and demonstrate major concepts in disciplines of Mathematics, Physics and Chemistry

PO 2: Think independently and methodically arrive at logical conclusions

PO 3: Create awareness of impact of modern knowledge on the environment and society

PO 4: Create Scientific Attitude and Rational Thinking in Students

PO 5: Develop the attitude of child of young student into that of a Corporate being

PO 6: Improve communication and Soft skills to harness the power of modern advancements in Technology

PO 7: Graduates attain practical knowledge through hands-on training and project experience to meet the industrial needs.

PO 8: To acquire knowledge of engineering skills to design and conduct experiments, analyze data and interpret results.

PO 9: To acquire first-hand experience in working on projects at individual level and exposure to industrial and research fields.

PO 10: To demonstrate the modern engineering techniques used in biotechnology and apply technological solutions in various fields of modern biotechnological applications.

PO 11: The commerce and finance focused curriculum offers a number of specializations and practical exposures which would equip the student to face the modern-day challenges in commerce and business.

PO 12: The all-inclusive outlook of the course offer a number of value based and job oriented courses ensures that students are trained into up-to-date. In advanced accounting courses beyond the introductory level, affective development will also progress to the valuing and organization levels.

PO 13: Students will develop in depth understanding of biomolecular behavior and describe the molecular and structural unity of life, develop a thorough knowledge of research techniques in biochemistry.

PO 14: Students will be able to understand the fundamental theories, concepts, and applications in 4 basic areas of research in chemistry

PO 15: They will be able to understand the basic concepts of microbial flora and fauna, how microorganisms can be used as model systems to study basic biology, [illegible] metabolism and ecology. Also, be able to identify how microorganisms play

U – 1,13

K – 7,8

C – 3,4

Note:

1.The question paper setters are requested to kindly adhere to the format given in the above table.

2.The question paper setters are also requested to set the questions in the following way:

a. 80 % of Questions - Memory and Understanding based

b. 20 % of Questions - Creativity, Application and Skill based

MODEL PAPER

DR. V.S. KRISHNA GOVT. DEGREE & P.G. COLLEGE, VISAKHAPATNAM

B.SC. DEGREE EXAMINATION SEMESTER-II

B.Sc PHY(H)-MINOR-CHEMISTRY-I

INORGANIC AND GENERAL CHEMISTRY

Time: 3 hours **Maximum Marks - 75 Marks**

PART-A **(5x5 = 25 Marks)**

Answer any FIVE of the following questions

1. Define ionic radii and covalent radii.
2. Explain shielding effect.
3. Write a short note on Heisenberg uncertainty principle
4. Describe Hydrogen bonding and its types by taking one example each?
5. Define semiconductors and insulators. Give suitable examples.
6. Write about Bronsted-Lowry acid-base concept
7. Write a short note on Born-Haber cycle.
8. Discuss Valence bond theory to explain structure in simple molecules?

PART-B **(5x10 = 50 Marks)**

Answer ALL the questions

9. (a) What is Electronegativity? Discuss Pauling, Mülliken, Allred Rachow scales of electronegativity?

Or

(b) Define ionization enthalpy. Explain factors affecting and applications ionization enthalpy?

10. (a) Explain atomic spectrum of hydrogen atom?

Or

(b) Derive Schrodinger's equation.

11. (a) Explain bonding in metals by using free electron model?

Or

(b) Explain vanderwaals, dipole-dipole and induced dipole forces.

12. (a) Discuss Born Haber cycle and its applications?

Or

(b) Write an essay on Valence shell electron pair repulsion theory (VSEPR)

13. (a) Explain the HSAB theory with applications.

Or

(b) Explain the following

(i) Arrhenius acid base theory

(ii) Lewis acid base theory

DR. V.S. KRISHNA GOVT. DEGREE & P.G. COLLEGE, VISAKHAPATNAM
B.SC. DEGREE EXAMINATION
SEMESTER – IV - B.Sc PHY(H)-MINOR-CHEMISTRY-II
Physical and Organic chemistry

Learning Objectives:

On completion of this course, the students will be able to understand:

LO1.Isotherms of real gases and their comparison with Van der Waals isotherms.
LO2.Collision frequency & collision diameter.
LO3.Elementary ideas of symmetry and symmetry elements.
LO4.Vapour pressure, surface tension, viscosity.
LO5.Hybridization and Shapes of molecules.
LO6.Optical Activity and Specific Rotation.

Course Outcomes:

After completion of the course students are able to learn about:

CO1.Law of corresponding states.
CO2.Bragg's law, a simple account of rotating crystal method and powder pattern method.
CO3.Hyperconjugation and their applications.
CO4.Markownikoff and Anti Markownikoff addition.
CO5. Electrophilic substitution in benzene.
CO6. Enantiomers and Diastereoisomers.

Physical and Organic chemistry(60H)
SYLLABUS

MODULE -I :**Gaseous state** **12H**

Behavior of real gases: Deviations from ideal gas behavior, compressibility factor, and its variation with pressure for different gases. Causes of deviation from ideal behavior. van der Waals equation of state, its derivation and application in explaining real gas behaviour; van der Waals equation expressed in virial form, Boyle temperature. Isotherms of real gases and their comparison with van der Waals isotherms, continuity of states, critical state, critical and van der Waals constants, law of corresponding states.

Kinetic molecular model of a gas: Postulates and derivation of the kinetic gas equation; collision frequency; collision diameter; mean free path and viscosity of gases, including their temperature and pressure dependence, relation between mean free path and coefficient of viscosity, calculation of σ from η; variation of viscosity with temperature and pressure.

MODULE -II: Solid state and Liquid state
15H

Solid state:

Nature of the solid state, law of constancy of interfacial angles, law of rational indices, Miller indices, elementary ideas of symmetry, symmetry elements and symmetry operations, qualitative idea of point and space groups, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method. Analysis of powder diffraction patterns of NaCl, CsCl and KCl. Various types of defects in crystals, Glasses and liquid crystals.

Idea of point and space groups, seven crystal systems and fourteen Bravais lattices; X-ray diffraction, Bragg's law, a simple account of rotating crystal method and powder pattern method.

Analysis of powder diffraction patterns of NaCl, CsCl and KCl. Various types of defects in crystals, Glasses and liquid crystals.

Adsorption: Freundlisch and Langmuir adsorption Isotherms.

Liquid state:

Structure and physical properties of liquids; vapour pressure, surface tension, viscosity, and their dependence on temperature, Effect of addition of various solutes on surface tension, cleansing action of detergents. Structure of water.

MODULE -**III: Basics of Organic Chemistry:** **10H**

Organic Compounds: Classification, and Nomenclature, Hybridization, Shapes of molecules, Influence of hybridization on bond properties. Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation and their applications; Dipole moment; Organic acids and bases; their relative strength. Homolytic and Heterolytic fission with suitable examples. Curly arrow rules, formal charges; Electrophiles and Nucleophiles; Nucleophlicity and basicity; Types, shape and relative stabilities of reaction intermediates (Carbocations, Carbanions, Free radicals and Carbenes).

Organic reactions and their mechanism: Addition, Elimination and Substitution reactions.

MODULE -**IV: Chemistry of Alkanes,Alkenes,Alkynes and Aromatic compounds** **15H**

Preparationof alkanes by Wurtz Reaction, Wurtz- Fittig Reactions and Reaction of alkanes by substitution of halogens.

Preparation of alkenes and alkynes by elimination reactions, Saytzeff and Hofmann eliminations. Reactions of alkenes-Markownikoff and Anti Markownikoff addition.

Classification of dienes, Diels- Alder reaction. Reactions of alkynes: Acidity, Electrophilic and Nucleophilic additions.

Aromatic Hydrocarbons

Aromaticity: Huckel's rule, aromatic character of arenes, cyclic carbocations/carbanions and heterocyclic compounds with suitable examples. Examples of mono and di substituted aromatic compounds. Electrophilic substitution in benzene by halogenation, nitration, sulphonation and Friedel-Craft's alkylation/acylation with their mechanism. Orientation of mono substituted benzene for di substitution, Ortho,Para and Meta directing groups.

MODULE -V: Stereochemistry **8H**

Concept of asymmetry, Fischer Projection, Newmann and Sawhorse projection formulae and their interconversions; Geometrical isomerism: cis–trans and, syn-anti isomerism E/Z notations with C.I.P rules. Optical Isomerism: Optical Activity, Specific Rotation, Chirality/Asymmetry, Enantiomers, Molecules with two or more chiral-centres, Distereoisomers, meso structures, Racemic mixtures, Relative and absolute configuration: D/L and R/S designations.

Reference Books:

1. Morrison, R. N. & Boyd, R. N. *Organic Chemistry*, Dorling Kindersley (India) Pvt. Ltd. (Pearson Education).
2. Kalsi, P. S. *Stereochemistry Conformation and Mechanism*, New Age International, 2005.
3. McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013.
1. Atkins, P. W. & Paula, J. de *Atkin's Physical Chemistry* 10th Ed., Oxford University Press (2014).
3. Ball, D. W. *Physical Chemistry* Thomson Press, India (2007).

MODEL PAPER

DR. V.S. KRISHNA GOVT. DEGREE & P.G. COLLEGE, VISAKHAPATNAM

B.SC. DEGREE EXAMINATION

SEMESTER – IV - B.Sc PHY(H)-MINOR-CHEMISTRY-II

Time: 3 hours **Maximum Marks - 75 Marks**

PART-A **(5x5 = 25 Marks)**

Answer any **FIVE** questions 5 X 5= 25 Marks

1. Define electrophile and Nucleophiles? Give example.
2. Write the Diel's -Alder reaction.
3. State and explain Markownikoff's rule.
4. Discuss Geometrical isomerism.
5. Write the Andrew' isotherms of Carbon dioxide.
6. State the postulate of kinetic theory of gases.
7. Write the applications of liquid crystals.
8. Define surface tension of a liquid. Write the variation of surface tension with temperature.

Answer **ALL** the questions 5 X 10= 50 Marks

9. (a) Derive the Vanderwall's gas equation.

Or

(b) Derive the relationship between Vanderwall's constants and critical constants.

10. (a) Explain Langmuir adsorption isotherms?

Or

(b) Discuss briefly Crystal defects.

11. (a) Explain briefly Inductive effect and Mesomeric effect?

Or

(b) Write a note on the stabilities of any 3 reaction intermediates.

12. (a) Give any two methods of preparations of alkanes. Write the Halogenation of alkanes.

Or

(b) Explain aromaticity with examples?

13.(a) Write short note on enantiomers and diastereomers.

Or

(b) Explain the optical isomers of Tartaric acid?