DEPARTMENT OF CHEMISTRY

PROGRAMME: B.Sc. CHEMISTRY (Hons)

SYLLABUS UNDER CBCS FRAMEWORK WITH EFFECT
From 2020-2021

(With Learning Outcomes, Unit-wise Syllabus, References,
Co -curricular Activities & Model Q.P)

Dr. V. S. Krishna Govt. Degree & PG College (A)

(NAAC Reaccredited A Grade Institution & District Identified College)
CENTRE FOR RESEARCH STUDIES

Visakhapatnam- 530 013, Andhra Pradesh, INDIA

Board Of Studies January- 2021

Dr. V. S. Krishna Govt. Degree & PG College (A)

(NAAC Reaccredited A Grade Institution & District Identified College)

Visakhapatnam- 530 013, Andhra Pradesh, INDIA

Resolutions/ Minutes of the 6th Board of Studies, Jan-2021

Subject: CHEMISTRY Department: CHEMISTRY

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 (CDC)/Dr. V S K. Govt. College/BOS/2020 dt.19.03.2020 of the Vice-Chancellor, Andhra University Visakhapatnam, the 6th Board of Studies in **Chemistry (Hons)** Subject is conducted on **28.01.2021** at 11.30 AM will the following members. The changes will be implemented from 2020-21 academic year onwards

MEMBER	NAME & DESIGNATION	SIGNATURE
Head of the Department (Chairman)	Dr. K. Bharath Kumar Naik HOD, Chemistry	
Faculty members	Smt. J L Mangamma Lecturer in Chemistry	
	Sri A. Ramesh Lecturer in Chemistry-CF	
	Smt. R. Sailaja Lecturer in Chemistry-CF	
	Dr. B. Sudhamsha Lecturer in Chemistry-CF	
Subject Expert (University Nominee)	Dr. K. Basavaiah Professor, School of Chemistry-AU	
Subjects Experts (From outside the parent University)	Dr. S. Ramakrishna Dept. of Chemistry GDC(M), Srikakulam	
	Dr. N. Vijay Kumar HOD, Chemistry DNR College, Bhimavaram West Godavari-AP	
Representative member from Industry/Corporate/Allied area relating to placement	Dr. N. Rambabu Senior Manager QC, HPCL-Vizag	
Member from Alumni	Dr. Ch.V.M. K. Hari HOD, Copt. Sc.,	
Coordinator, IQAC	Dr. Ch. Lalitha HOD, Micro. Biol.	
Coordinator, Academic Council	Dr. S Sravan Kumar HOD, Physics	
Chairperson, Academic Council	Dr. V. Chandrasekhar Principal	

DEPARTMENT OF CHEMISTRY

PROGRAMME: B.Sc. CHEMISTRY (Hons)

SYLLABUS UNDER CBCS FRAMEWORK WITH EFFECT
From 2020-2021

(With Learning Outcomes, Unit-wise Syllabus, References,
Co -curricular Activities & Model Q.P)

Dr. V. S. Krishna Govt. Degree & PG College (A)
(NAAC Reaccredited *A* Grade Institution & District Identified College)
CENTRE FOR RESEARCH STUDIES

Visakhapatnam- 530 013, Andhra Pradesh, INDIA

Board Of Studies October- 2020

Programme outcomes:

On successful completion of the **B.Sc Chemistry (Honours)** 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.

COURSES OFFERED UNDER B.Sc. (Honours) CHEMISTRY PROGRAMME (CBCS)

SEMESTER	COURSE	COURSE CODE	COURSE NAME	CREDITS (T+P)	Hours per week
I	I	CHE (II)-CC I	INORGANIC CHEMISTRY I - ATOMIC STRUCTURE & CHEMICAL BONDING	4+1	4+3
		CHE(II)-CC II	PHYSICAL CHEMISTRY I - STATES OF MATTER & IONIC EQUILIBRIUM	4+1	4+3
II	II	CHE(II)-CC III	ORGANIC CHEMISTRY I - BASICS AND HYDROCARBONS	4+1	4+3
		CHE(II)-CC IV	PHYSICAL CHEMISTRY II - CHEMICAL THERMODYNAMICS AND ITS APPLICATIONS	4+1	4+3
III	III	CHE(H)-CC V	INORGANIC CHEMISTRY II – S & P-BLOCK ELEMENTS	4+1	4+3
		CHE(II)-CC VI	ORGANIC CHEMISTRY II - OXYGEN CONTAINING FUNCTIONAL GROUPS	4+1	4+3
IV	IV	CHE(II)-CC VII	ORGANIC CHEMISTRY III – HETEROCYCLIC CHEMISTRY	4+1	4+3
		CHE(II)-CCVIII	PHYSICAL CHEMISTRY III - PHASE EQUILIBRIA AND CHEMICAL KINETICS	4+1	4+3
	V	CHE(II)-CC IX	INORGANIC CHEMISTRY III - COORDINATION CHEMISTRY AND GREEN CHEMISTRY	4+1	4+3
		CHE(H)-CC X	PHYSICAL CHEMISTRY V - QUANTUM CHEMISTRY & SPECTROSCOPY	4+1	4+3
		CHE(H)-CC XI	ANALYTICAL AND MATERIALS CHEMISTRY	4+1	4+3

CHEMISTRY MINOR COURSE FOR OTHER DEPARTMENT

SEMESTER	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

SEMESTER I

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

Learning objective:

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

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.

Course Outcomes:

After completion of the course students are able to understand:

CO1.structure of atom, ,electronic configuration.

CO2.different types of bonds and bonding,types of structures.

CO3.orbital diagrams of various homo and heteroatomic molecules.

CO4.the differences between conductors,semicoductors and insulators.

CO5.molecular orbital diagrams and the calculation of Bond order.

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

SYLLABUS

Unit-I: Atomic Structure **12H**

Bohr'stheory, 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.

Unit-II: Periodicity of *s*, *p*, *d*- block elements **12H**

s, *p*, *d*, block elements, the long form of periodic table. Detailed discussion of the following 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, Pauling's/ Mulliken's/ electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization.

Unit-III: Periodicity of *f*-block elements **12H**

f-block elements, the long form of periodic table. Detailed discussion of the following 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) Electronegativity

Chemical bonding-1

Ionic bond: General characteristics, types of ions, size effects, radius ratio rule and its limitations. 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.

Unit-IV : Chemical bonding-2 **16H**

(i) *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 N_2, O_2, C_2, B_2, F_2, CO, NO, and their ions; HCl, BeF_2, CO_2, (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.

Unit-V: Chemical bonding-3 **8H**

(iii) *Metallic Bond:* Qualitative idea of valence bond and band theories. Semiconductors and insulators, 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 $KMnO_4$ solution.

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

(iii)Estimation of Fe(II) with $K_2Cr_2O_7$ using internal **external** (diphenylamine, anthranilic acid) and external indicator.

Reference text:

1. Mendham, J., A. I. Vogel's *Quantitative Chemical Analysis 6th Ed.*, Pearson, 2009.

Guidelines to the Paper Setter:

The syllabus I Semester consists of **INORGANIC CHEMISTRY I - ATOMIC STRUCTURE & CHEMICAL BONDING**

The I Semester question paper consists of 2 sections.

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 has to choose 2 question from each unit from of **INORGANIC CHEMISTRY I - ATOMIC STRUCTURE &CHEMICAL BONDING**

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-I Paper-I

BLUE PRINT

INORGANIC CHEMISTRY I - ATOMIC STRUCTURE &CHEMICAL BONDING

Sl. No	UNITS	Name of the chapter	10 Marks	5 Marks
1.	UNIT-I	Atomic Structure	2	2
2.	UNIT-II	Periodicity of *s*, *p*, *d*- block elements	2	2
3.	UNIT-III	Periodicity of *f*-block elements : Chemical bonding-1	2	1
4.	UNIT-IV	Chemical bonding-2	2	2
5.	UNIT-V	Chemical bonding-3	2	1

MODEL PAPER

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:** 75Marks

PART- A

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

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

PART- B

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

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

(OR)

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

10. (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)

(b) Explain MOT diagrams of the following molecules

(i) N_2 (ii) CO_2

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

(OR)

(b) Explain the following. (i) Vander waals forces

(ii) Hydrogen bonding

SEMESTER - I
CHE(H)-CC-II CHEMISTRY I - STATES OF MATTER & IONIC EQUILIBRIUM

Learning objective:

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

LO1.Familiarization with various states of matter.

LO2.Physical properties of each state of matter and laws related to describe the states.

LO3.Calculation of lattice parameters.

LO4.Electrolytes and electrolytic dissociation, salt hydrolysis and acid-base equilibria.

LO5.Understanding Kinetic model of gas and its properties.

Course Outcomes:

After completion of the course students are able to understand:

CO1.Behaviour of gases.

CO2.Symmetry elements and indices.

CO3.Electrolytes,degree of ionization and about buffer solutions.

CO4.The differences between ideal and non ideal gases.

CO5.Calculate the physical parameters like surface tension and viscosity.

CHE(H)-CC-II CHEMISTRY I - STATES OF MATTER & IONIC EQUILIBRIUM(60H)
SYLLABUS

UNIT-I: 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.

UNIT-II: 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.

UNIT-III: Solid state **10H**

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.

UNIT-IV: Ionic equilibria-1 **15H**

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.

UNIT-V: Ionic equilibria-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).

CHE(H)-CC-II PHYSICAL CHEMISTRY -I LAB

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.*; McGraw-Hill: New York (2003).
3. Halpern, A. M. & McBane, G. C. *Experimental Physical Chemistry 3rd Ed.;* W.H. Freeman & Co.: New York (2003).

Guidelines to the Paper Setter: The syllabus II Semester consists of:
PHYSICAL CHEMISTRY I - STATES OF MATTER &
IONIC EQUILIBRIUM

. The I Semester question paper consists of 2 sections.

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 has to choose 2 question from each unit from :

PHYSICAL CHEMISTRY I - STATES OF MATTER &
IONIC EQUILIBRIUM

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-I
Paper-II
BLUE PRINT

CHE(H)-CC-II CHEMISTRY I - STATES OF MATTER &
IONIC EQUILIBRIUM

Sl. No	UNITS	Name of the chapter	10 Marks	5 Marks
1.	UNIT-I	Gaseous state	2	2
2.	UNIT-II	Liquid state	2	2
3.	UNIT-III	Solid state	2	1
4.	UNIT-IV	Ionic equilibria-1	2	2
5.	UNIT-V	Ionic equilibria-2	2	1

MODEL PAPER
B. Sc, DEGREE FIRST YEAR EXAMINATIONS
Paper –II , SEMESTER- I
CHE(H)-CC-II 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 ionisation .
7. Write about common ion effect.
8. Write about solubility product.

PART- B

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

9. (a)Write the postulates and derivation of kinetic gas equation.

(OR)

(b) Derive Vander waals equation of state and write application in explaining in real gas behavior.

10. (a) Explain determination of sufacetension of liquids.

OR

(b) Explain determination of coefficient of viscosity of liquids.

11. (a) Explain symmetry elements and symmetry operations

OR

(bDerive bragg's equation and explain the experimental determination by powder method.

12. (a) Write the following
    (i) factors affecting degree of ionisation
    (ii) pH scale

OR

(b) Derive Henderson equation and write its applications.

13. (a)Write the qualitative treatmentof acid base titration curves.

(OR)

(b)Write the theory of acid base indicators.

SEMESTER II

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

Learning objective:

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

Unit-I: Basics of Organic Chemistry **13H**

Organic Compounds: Classification, and Nomenclature, Hybridization.

Electronic Displacements: Inductive, electromeric, resonance and mesomeric effects, hyperconjugation, Dipole moment.

Homolytic and Heterolytic fission with suitable examples. Electrophiles and Nucleophiles; Nucleophlicity 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).

UNIT-II: Stereochemistry: **12H**

Fischer Projection, Newmann and Sawhorse Projection formulae; 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, Racemic mixture and resolution. Relative and absolute configuration: D/L and R/S designations.

UNIT-III: Chemistry of Aliphatic Hydrocarbons-1 **10H**

Carbon-Carbon sigma bonds

Chemistry of alkanes: Formation of alkanes, Wurtz Reaction, Wurtz-Fittig Reactions, Free radical substitutions: Halogenation.

Carbon-Carbon pi bonds:

Formation of alkenes and alkynes by elimination reactions, Mechanism of E1, E2, E1cb reactions. Saytzeff and Hofmann eliminations.

UNIT -IV 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 of alkanes: Relative stability: Energy diagrams of cyclohexane: Chair, Boat and Twist boat forms.

UNIT -V Aromatic Hydrocarbons **15H**

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. 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.

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.
5. Chromatography
   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 (TLC)

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)

Guidelines to the Paper Setter: The syllabus III Semester consists of

ORGANIC CHEMISTRY I - BASICS AND HYDROCARBONS

. The III Semester question paper consists of 2 sections.

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 has to choose 2 question from each unit from

ORGANIC CHEMISTRY I - BASICS AND HYDROCARBONS

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-II

Paper-III

BLUE PRINT

CHE(H)-CC-III

ORGANIC CHEMISTRY I - BASICS AND HYDROCARBONS

Sl. No	UNITS	Name of the chapter	10 Marks	5 Marks
1.	UNIT-I	Basics of Organic Chemistry	2	2
2.	UNIT-II	Stereochemistry	2	2
3.	UNIT-III	Chemistry of Aliphatic Hydrocarbons-1	2	1
4.	UNIT-IV	Chemistry of Aliphatic Hydrocarbons-2 Cycloalkanes and Conformational Analysis	2	2
5.	UNIT-V	Aromatic Hydrocarbons	2	1

MODEL PAPER

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:** 75Marks

PART- A

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

1. Define electrophiles and nucleophiles.
2. Define enantiomers . Give examples.
3. Write saytzeff"s rule.
4. Write a short notes on Diels-Alder reaction.
5. Explain carbocations and carbanions.
6. Explain specific rotation .
7. What is 1,4-Addition reaction in conjugated dienes.
8. Explain Huckle"s rule and give examples.

PART- B

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

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 following reactions

(i) Wurtz reaction (ii) wurtz fitting reaction.

OR

(b)Write an account of eliminations reactions and write their mechanisms.

12. (a) . Explain the following reactions

(i) Markownikoff's rule (ii)) Anti markownikoff's rule

OR

(b)Explain baeyer's strain theory.

13. (a)Explain nitration and sulphonation reactions and their mechanisms.

(OR)

(b) Explain friedel crafts alkylation and friedel crafts acylation reactions and their mechanisms

SEMESTER II

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

Learning objective:

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

LO1.The laws of thermodynamics.

LO2.Concepts of internal energy,entropy.

LO3.Gibb's Helmholtz equqtion and Maxwell relations

LO4.Concept of Fugacity.

LO5.Lowering of vapour pressure,elevation of boiling point,etc., and their relation with the amountof solute.

Course Outcomes:

After completion of the course students are able to understand:

CO1. zeroth law of thermodynamics,Concept of heat, work,internal energy, *U*,

CO2. Concept of entropy; Gibbs and Helmholtz energy.

CO3. Le Chatlier principle.

CO4. Depression of freezing point, osmotic pressure.

CO5.The importance of colligative properties.

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

Unit-I: Chemical Thermodynamics -1 **11H**

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* , relation between heat capacities (ideal) under isothermal and adiabatic condition.

Unit-II: Chemical Thermodynamics -2 **10H**

Thermochemistry: Heats of reactions: standard states; enthalpy of formation of molecules and ions; calculation of bond energy, bond dissociation energy and resonance energy from thermochemical data.

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

Unit-III: Chemical Thermodynamics -3 **12H**

Third Law: Statement of third law, concept of residual entropy, calculation of absolute entropy of molecules.

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

Unit-IV: Chemical Equilibrium: **12H**

Criteria of thermodynamic equilibrium, degree of advancement of reaction, chemical equilibria in ideal gases, concept of fugacity. 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).

Unit-V:Solutions and Colligative Properties: **15H**

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.

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).

CHE(H)-CC-IV PHYSICAL CHEMISTRY - LAB

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: New Delhi (2001).

Guidelines to the Paper Setter: The syllabus IV Semester consists of
PHYSICAL CHEMISTRY II - CHEMICAL THERMODYNAMICS AND ITS APPLICATIONS
. The I Semester question paper consists of 2 sections.

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 has to choose 2 question from each unit from
. **PHYSICAL CHEMISTRY II - CHEMICAL THERMODYNAMICS AND ITS APPLICATIONS**

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

Sl. No	UNITS	Name of the chapter	10 Marks	5 Marks
1.	UNIT-I	Chemical Thermodynamics -1	2	2
2.	UNIT-II	Chemical Thermodynamics -2	2	2
3.	UNIT-III	Chemical Thermodynamics -3	2	1
4.	UNIT-IV	Chemical Equilibrium	2	2
5.	UNIT-V	Solutions and Colligative Properties	2	1

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 thermodynamics.

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.

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

Learning objective:

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

LO1. Methods of purification of metals.
LO2. Bronsted-Lowry and Lewis acid-base concept.
LO3. Allotropy and catenation properties of s and p block elements.
LO4. Nature of bonding in noble gas compounds.
LO5. Types of inorganic polymers.

Course Outcomes:

After completion of the course students are able to understand:

CO1. Hard and Soft Acids and Bases (HSAB) theory.
CO2. Structure, bonding, preparation, properties and uses of Boric acid and borates, boron nitrides, borohydrides (diborane) carboranes, silanes etc.,
CO3. Preparation and properties of XeF_2, XeF_4 and XeF_6.
CO4. Synthesis, structural aspects and applications of phosphazenes, and polysulphates.
CO5. The stability of various oxidation states of p block elements.

CHE(H)-CC-V INORGANIC CHEMISTRY II – S & P-BLOCK ELEMENTS(60H)
SYLLABUS

Unit-I: General Principles of Metallurgy **15H**

Chief modes of occurrence of metals based on standard electrode potentials. 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.

Acids and Bases

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.

Unit-II: Chemistry of *s* Block Elements: **10H**

Inert pair effect, Relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group. Allotropy and catenation. Complex formation tendency of *s* block elements.

Hydrides and their classification ionic, covalent and interstitial.

Unit-III: Chemistry of *p* Block Elements **15H**

Inert pair effect, Relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group. Allotropy and catenation. Complex formation tendency of *p* block elements.

Hydrides and their classification ionic, covalent and interstitial. Basic beryllium acetate and nitrate.

Study of the following compounds with emphasis on structure, bonding, preparation, properties and uses.

Boric acid and borates, boron nitrides, borohydrides (diborane) carboranes, silanes, Oxides and oxoacids of nitrogen, Phosphorus and chlorine. Peroxo acids of sulphur, interhalogen compounds.

Unit-IV: Noble Gases **10H**

Occurrence 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).

Unit-V: Inorganic Polymers **10H**

Types of inorganic polymers, comparison with organic polymers, synthesis, structural aspects and applications of silicones and siloxanes. Borazines, silicates and phosphazenes, and polysulphates.

Reference Books:

1. Lee, J.D. *Concise Inorganic Chemistry*, ELBS, 1991.
2. Cotton, F.A. & Wilkinson, G. *Advanced Inorganic Chemistry*, Wiley, VCH, 1999.

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

(A) Iodo / Iodimetric Titrations

(i) Estimation of Cu(II) and K2Cr2O7 using sodium thiosulphate solution (Iodimetrically).

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

(B) Inorganic preparations

(i) Cuprous Chloride, Cu2Cl2

(ii) Preparation of Manganese(III) phosphate, MnPO4.H2O

(iii)Preparation of Aluminium potassium sulphate KAl(SO4)2.12H2O (Potash alum) or Chrome alum.

Reference Books:

Mendham, J., *A. I. Vogel's Quantitative Chemical Analysis 6th Ed.*, Pearson, 2009.

Guidelines to the Paper Setter: The syllabus V Semester consists of
INORGANIC CHEMISTRY II – S & P-BLOCK ELEMENTS
. The I Semester question paper consists of 2 sections.

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 has to choose 2 question from each unit from **INORGANIC CHEMISTRY II – S & P-BLOCK ELEMENTS**

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-III
Paper-V
BLUE PRINT
CHE(H)-CC-V
INORGANIC CHEMISTRY II – S & P-BLOCK ELEMENTS (CC)

Sl. No	UNITS	Name of the chapter	10 Marks	5 Marks
1.	UNIT-I	General Principles of Metallurgy Acids and Bases	2	2
2.	UNIT-II	Chemistry of *s* Block Elements	2	2
3.	UNIT-III	Chemistry of *p* Block Elements	2	1
4.	UNIT-IV	Noble Gases	2	2
5.	UNIT-V	Inorganic Polymers	2	1

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 5 X 5 = 25 Marks

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

1. Write parting process.
2. Write electrolytic reduction.
3. Write inert pair effect.
4. Explain diagonal relationship.
5. Explain silanes.
6. Write short note on boran nitrides.
7. what are clathrates ? Write preparation and property.
8. Define phosphazenes and polysulphates .Give examples.

PART- B 5X 10 = 50 Marks

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

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

(Or)

(b) Explain HSAB principle.

10.a) . Explain the following

(i)Relative stability of different oxidation states (S- block elements)

(ii)Allotropy and catenation

(or)

(b). Define hydrides. Write their classification. (S- block elements)

11.(a). Discuss about boric acid and borates.

(or)

(b) Explain oxides and oxoacids of nitrogen.

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

(or)

(b). Write VB and MOT treatment for XeF_2

13.(a). Explain types of inorganic polymers.

(or)

b).Explain synthesis, structural aspects and applications of silicones and siloxanes.

SEMESTER-III

CHE(H)-CC-VI ORGANIC CHEMISTRY II - OXYGEN CONTAINING FUNCTIONAL GROUPS

Learning objective:

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

LO1.Substitution nucleophilic unimolecular and bimolecular reactions.

LO2.Reaction mechanisms such as Aldol, Benzoin, Cannizzaro,haloform,etc., reactions

LO3.Typical reactions of dicarboxylic acids, hydroxy acids and unsaturated acids: succinic, lactic, malic, tartaric, citric, maleic and fumaric acids;

LO4.Preparation and reactions of acid chlorides, anhydrides, esters and amides.

LO5.Mechanism of acidic and alkaline hydrolysis of esters, Claisen condensation, Dieckmann and Reformatsky reactions.

Course Outcomes:

After completion of the course students are able to understand:

CO1. Nucleophilic substitution, nucleophilic aromatic substitution reactions.

CO2. Pinacol-Pinacolone rearrangement, Reimer–Tiemann and Kolbe's–Schmidt Reactions with mechanism.

CO3. Active methylene compounds such as Aceto Acetic Ester, Malonic Ester.

CO4. Preparation and reactions of acid chlorides, anhydrides, esters and amides.

CO5. Preparation, properties and relative reactivity of 1°, 2°, 3° alcohols

CHE(H)-CC-VI ORGANIC CHEMISTRY II - OXYGEN CONTAINING FUNCTIONAL GROUPS(60H)

SYLLABUS

UNIT I: Chemistry of Halogenated Hydrocarbons: 12H

Alkyl halides: Methods of preparation, nucleophilic substitution reactions – SN1l 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.

UNIT II: Alcohols, Phenols, Ethers and Epoxides: 13H

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.

UNIT 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.

UNIT-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;

UNIT 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.

CHE(H)-CC-VI ORGANIC CHEMISTRY -II LAB

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).
   v. Selective reduction of *meta* dinitrobenzene to *m*-nitroaniline.
   vi. Reduction of *p*-nitrobenzaldehyde by sodium borohydride.
   viii. Hydrolysis of amides and esters.
   ix. Semicarbazone of any one of the following compounds: acetone, ethyl methyl ketone, cyclohexanone, benzaldehyde.
   x. Aldol condensation using either conventional or green method.

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).

Guidelines to the Paper Setter: The syllabus V ISemester consists of

ORGANIC CHEMISTRY II -

. The I Semester question paper consists of 2 sections.

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 has to choose 2 question from each unit from **ORGANIC CHEMISTRY II**

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-III

Paper-VI

BLUE PRINT

CHE(H)-CC-VI ORGANIC CHEMISTRY II - OXYGEN CONTAINING FUNCTIONAL GROUPS

Sl. No	UNITS	Name of the chapter	10 Marks	5 Marks
1.	UNIT-I	Chemistry of Halogenated Hydrocarbons	2	1
2.	UNIT-II	Alcohols, Phenols, Ethers and Epoxides	2	2
3.	UNIT-III	Carbonyl Compounds	2	2
4.	UNIT-IV	Carboxylic Acids	2	1
5.	UNIT-V	Carboxylic Acids Derivatives	2	2

MODEL PAPER

B.Sc., DEGREE EXAMINATION

SEMESTER-III

CHE(H)-CC-VI ORGANIC CHEMISTRY II - OXYGEN CONTAINING FUNCTIONAL GROUPS

Time: 3 hours Maximum Marks: 75

PART- A 5 X 5 = 25 Marks

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

9. Explain the mechanism of SN1 reaction.
10. Explain the pinacol pinacalone rearrangement.
11. Write the mechanism of Reimer–Tiemann reaction.
12. Explain the reaction of Michael addition.
13. Explain keto enol tautomerism.
14. Explain preparation of maleic acid .
15. Explain the mechanism of hydrolysis of ester.
16. Explain Claisen condensation reaction with mechanism.

PART- B 5X 10 = 50 Marks

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

9 (a). Explain SN2 reaction mechanism with stereochemical aspects and effect of solvent.

(or)

(b)write the preparation and nucleophilic aromatic substitution reactions of aryl halides.

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

(or)

(b). Explain preparation and properties of phenols.

11.(a). Explain the following reactions.

(i) Benzoin condensation (ii) Cannizaro reaction

(or)

(b) Explain the following reactions.

(a) Beckmann rearrangement (b) haloform reaction

12.(a). Write the preparation and properties of monocarboxylic acid

(or)

(b). Write the preparation and properties of dicarboxylic acid.

13.(a). Explain preparation and reactions of Acid chlorides.

(or)

(b).Explain preparation and reactions of amides.

SEMESTER-IV

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

Learning objective:

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

LO1. Preparation and important reactions of nitro compounds, nitriles and iso nitriles Amines.

LO2. Reactions of naphthalene phenanthrene and anthracene

LO3. Synthesis, reactions and mechanism of substitution reactions of Furan, Pyrrole,thiophene etc.,

LO4. The occurrence of Citral, Neral and α-terpineol.

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.

CHE(H)-CC-VII ORGANIC CHEMISTRY III – HETEROCYCLIC CHEMISTRY(60H) SYLLABUS

UNIT I: Nitrogen Containing Functional Groups **15H**

Preparation and important reactions of nitro and compounds, nitriles and isonitriles

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

Diazonium Salts: Preparation and their synthetic applications.

UNIT II: Polynuclear Hydrocarbons **12H**

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

UNIT III: Heterocyclic Compounds **15H**

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),

UNIT IV: Alkaloids **10H**

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

UNIT V: Terpenes **8H**

Occurrence, classification, isoprene rule; Elucidation of stucture and synthesis of Citral, Neral 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.

Singh, J.; Ali, S.M. & Singh, J. *Natural Product Chemistry*, Prajati Parakashan (2010)

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

Detection of extra elements.

1. Functional group test for nitro, amine 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).

Guidelines to the Paper Setter: The syllabus II Semester consists of **ORGANIC CHEMISTRY III – HETEROCYCLIC CHEMISTRY (CC)**. The II Semester question paper consists of 2 sections.

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-VII

BLUE PRINT

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

Sl. No	UNITS	Name of the chapter	10 Marks	5 Marks
1.	UNIT-I	Nitrogen containing Functional groups	2	2
2.	UNIT-II	Polynuclear Hydrocarbons	2	1
3.	UNIT-III	Heterocyclic Compounds	2	2
4.	UNIT-IV	Alkaloids	2	2
5.	UNIT-V	Terpenes	2	1

MODEL PAPER

B.Sc., DEGREE EXAMINATION

SEMESTER-IV

CHE(H)-CC-VII ORGANIC CHEMISTRY III – HETEROCYCLIC 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 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 general structural features 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 Dizonium salts.

10 (a) Explain the Preparation and structure elucidation 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 and synthesis of Hygrine and Nicotine

(or)

(b). Structure elucidation and synthesis of Nicotine.

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

(or)

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

***

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

Learning objective:

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

LO1. Concept of phases, components and degrees of freedom.
LO2. Nernst distribution law.
LO3. second order reactions.
LO4. Physical adsorption, chemisorption, adsorption isotherms.

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.

CHE(H)-CC-VIII PHYSICAL CHEMISTRY III - PHASE EQUILIBRIA AND CHEMICAL KINETICS(60H)
SYLLABUS

Unit-I: Phase Equilibria-1 **12H**

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.

Unit-II: Phase equilibria-2 **13H**

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.

Unit-III: Chemical Kinetics **15H**

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.

Unit-IV: Catalysis: **10H**

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

Unit-V: Surface chemistry: **15H**

Physical adsorption, chemisorption, adsorption isotherms – types- Langmuir and Freundlich isotherms

Surface active agents- classification- 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).

CHE(H)-CC-VIII PHYSICAL CHEMISTRY III LAB

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.

J.

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).

Guidelines to the Paper Setter: The syllabus II Semester consists of **PHYSICAL CHEMISTRY III**

. The II Semester question paper consists of 2 sections.

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-VIII
BLUE PRINT
CHE(H)-CC-VIII PHYSICAL CHEMISTRY III - PHASE EQUILIBRIA AND CHEMICAL KINETICS

Sl. No	UNITS	Name of the chapter	10 Marks	5 Marks
1.	UNIT-I	Phase Equilibria-1	2	2
2.	UNIT-II	Phase equilibria-2	2	1
3.	UNIT-III	Chemical Kinetics	2	2
4.	UNIT-IV	Catalysis	2	1
5.	UNIT-V	Surface chemistry	2	2

MODEL PAPER

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 5 X 5 = 25 Marks

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

1. Explainphase 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 Surface active agents.
8. Explain Freundlich isotherms.

PART- B 5X 10 = 50 Marks

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

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

(or)

(b) Explain Phase diagrams for systems of solid-liquid equilibria involving eutectic, congruent and incongruent melting points

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

Unit-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).

Unit-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,

Unit-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.

UNIT-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.

UNIT-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: The syllabus II Semester consists of **PHYSICAL CHEMISTRY III**

. The II Semester question paper consists of 2 sections.

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 BLUE PRINT CHE(H)-CC-IX INORGANIC CHEMISTRY III - COORDINATION CHEMISTRY AND GREEN CHEMISTRY				
Sl. No	**UNITS**	**Name of the chapter**	**10 Marks**	**5 Marks**
1.	UNIT-I	Transition Elements	2	2
2.	UNIT-II	Coordination Chemistry	2	2
3.	UNIT-III	Bioinorganic Chemistry	2	1
4.	UNIT-IV	Introduction to Green chemistry	2	1
5.	UNIT-V	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

SEMESTER-IV

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

Learning objective:

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

LO1. Schrodinger equation and its application to free particle and particle-in-a-box.
LO2. Statement of variation theorem and application to simple systems.
LO3. Vibrational Raman spectra, Stokes and anti-Stokes lines.
LO4. Electron Spin Resonance (ESR) spectroscopy.
LO5. Lambert-Beer's law and its limitations.

Course Outcomes:

After completion of the course students are able to understand:

CO1. Setting up of Schrödinger equation in spherical polar coordinates.
CO2. Rigid rotator model of rotation of diatomic molecule.
CO3. computation of force constant.
CO4. Electron Spin Resonance (ESR) spectroscopy.
CO5. Laws of photochemistry.

CHE(H)-CC-X PHYSICAL CHEMISTRY V - QUANTUM CHEMISTRY & SPECTROSCOPY(60H)

SYLLABUS

Unit –I: Quantum Chemistry-1 **10H**

Postulates of quantum mechanics, quantum mechanical operators, Schrödinger equation and its application to free particle and "particle-in-a-box" (rigorous treatment), 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.

Unit –II: Quantum Chemistry-2 **10H**

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^+. Qualitative extension to H_2. Comparison of LCAO-MO and VB treatments of H_2 (only wavefunctions, detailed solution not required).

Unit-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.

Unit-IV: Molecular Spectroscopy-2 **15H**

Electronic spectroscopy: Franck-Condon principle, electronic transitions, singlet and triplet states, fluorescence and phosphorescence.

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.

Unit-V: Photochemistry **10H**

Characteristics of electromagnetic radiation, 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 photosensitised reactions, quenching. Role of photochemical reactions in biochemical processes.

Reference Books:

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).

CHE(H)-CC-X PHYSICAL CHEMISTRY V LAB

UV/Visible spectroscopy

I. Study the 200-500 nm absorbance spectra of KMnO4 and K2Cr2O7 (in 0.1 M H2SO4) and determine the λmax values. Calculate the energies of the two transitions in different units (J molecule^{-1}, kJ mol^{-1}, cm^{-1}, eV).

II. Study the pH-dependence of the UV-Vis spectrum (200-500 nm) of K2Cr2O7.

Colorimetry

I. Verify Lambert-Beer's law and determine the concentration of CuSO4/KMnO4/K2Cr2O7 in a solution of unknown concentration

II. Determine the concentrations of KMnO4 and K2Cr2O7 in a mixture.

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

V. Determine the dissociation constant of an indicator (phenolphthalein).

VI. Study the kinetics of interaction of crystal violet/ phenolphthalein with sodium hydroxide.

VII. Analysis of the given vibration-rotation spectrum of HCl(g)

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).

Guidelines to the Paper Setter: The syllabus I Semester consists of physical chemistry v - quantum chemistry & spectroscopy (cc). The I Semester question paper consists of 2 sections.

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 has to choose 2 question from each unit from **physical chemistry v - quantum chemistry & spectroscopy** 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-X

BLUE PRINT

CHE(H)-CC-X

PHYSICAL CHEMISTRY V - QUANTUM CHEMISTRY & SPECTROSCOPY

Sl. No	UNITS	Name of the chapter	10 Marks	5 Marks
1.	UNIT-I	Quantum Chemistry-1	2	1
2.	UNIT-II	Quantum Chemistry-2	2	2
3.	UNIT-III	Molecular Spectroscopy-1	2	2
4.	UNIT-IV	Molecular Spectroscopy-2	2	1
5.	UNIT-V	Photochemistry	2	2

MODEL PAPER

B.Sc., DEGREE EXAMINATION

SEMESTER-IV,PAPER-X

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

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 Vibrational energy of diatomic molecules.

2.Explain the Schrödinger equation in spherical polar coordinates.

3.Write about valence bond theory.

4.Explain types of molecular spectra.

5. Explain isotopic substitution..

6.Explain Franck-Condon principle.

7.Explain ESR of simple radicals.

8.Write about laws of photochemistry.

PART- B 5X 10 = 50 Marks

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

9 (a). Derive Schrödinger equation of particle-in-a-box . .

(or)

(b) Explain simple harmonic oscillator

10 (a)Explain variation theorem and application to simple systems..

(or)

(b). Explain Qualitative extension to H2. Comparison of LCAO-MO and VB treatments of H2

11.(a). Explain Classical equation of vibration.

(or)

(b) Explain Vibrational Raman spectra

12.(a). Write the types of electronic transitions with examples.

(or)

(b).Explain the following

(i) chemical shift (ii) spin spin coupling

13.(a). Explain Lambert-Beer's law and its limitations.

(or)

(b).What is quantum yield,? Explain high quantum yield with example

SEMESTER-IV

CHE(H)-CC-XI ANALYTICAL AND MATERIALS CHEMISTRY

Learning Objectives:

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

LO1. Basic principles of instrumentation

LO2. Basic principle of pH metric, potentiometric and conductometric titrations.

LO3. Development of chromatograms in chromatography.

LO4. Zeolites, metallosilicates, silicalites and related microporous materials.

LO5. Preparation of gold and silver metallic nanoparticles.

Course Outcomes:

After completion of the course students are able to understand:

CO1. Errors, accuracy and precision

CO2. Fundamental laws of spectroscopy and selection rules.

CO3. Basic principles of instrumentation.

CO4. Mechanism of separation in adsorption, partition & ion exchange methods.

CO5. Environmental effects on composites.

CO6. Synthesis and application of imidazolium and phosphonium based ionic liquids.

CHE(H)-CC-XI ANALYTICAL AND MATERIALS CHEMISTRY(60H)
SYLLABUS

Unit –I: Vibration spectroscopy: **10H**

Basic principles of instrumentation, sampling techniques. Application of IR spectroscopy for characterization through interpretation of data, Effect and importance of isotope substitution. Introduction to Raman spectra

UV-Visible Spectrometry: Basic principles of instrumentation, principles of quantitative analysis using estimation of metal ions from aqueous solution, Determination of composition of metal complexes using Job`s method of continuous variation and mole ratio method.

Unit –II:Thermal analysis **10H**

Theory of thermogravimetry (TG and DTG), instrumentation, estimation of Ca and Mg from their mixture.Electroanalytical methods: (6 classes of 60 minutes duration each)

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

Unit –III: Separation techniques **10H**

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 from aqueous solution, extraction of organic species from the aqueous and non- aqueous media.

Chromatography techniques: Classification, principle and efficiency of the technique. Mechanism of separation: adsorption, partition & ion exchange. Development of chromatograms: frontal, elution and displacement methods. Qualitative and quantitative aspects of chromatographic methods of analysis using LC, GLC, TLC and HPLC.

Unit –IV Silica based materials **15H**

Introduction to Zeolites, metallosilicates, silicalites and related microporous materials, Mesoporous silica, metal oxides and related functionalized mesoporous materials: Covalent organic frameworks, Organic-Inorganic hybrid materials, periodic mesoporous organo silica, metal organic frameworks: H2 /CO2 gas storage and catalytic applications.Inorganic solids/ionic liquids of technological importance: (8 classes of 60 minutes duration each)
Preparation of inorganic solids: Conventional heat and beat methods, Co-precipitation method, Sol-gel methods, Hydro-thermal method, Ion-exchange and Intercalation methods. Introduction to Solid electrolytes, inorganic liquid crystals. Ionic liquids, forces responsible for ionic liquids, synthesis and application of imidazolium and phosphonium based ionic liquids. Host-guest chemistry (elementary ideas).

Unit –V:Nanomaterials **15H**

Overview of nanostructures and nano-materials: classification. Preparation of gold and silver metallic nanoparticles, self-assembled nanostructures-control of nano-architecture-one dimensional control. Carbon nanotubes and inorganic nanowires.
Composite materials: (8 classes of 60 minutes duration each)
Introduction, limitations of conventional engineering materials, role of matrix in composites, classification, matrix materials, reinforcements, metal-matrix composites, polymer-matrix composites, fibre-reinforced composites, environmental effects on composites, applications of composites.

Reference Books

1 Mendham, J., *A. I. Vogel's Quantitative Chemical Analysis 6th Ed.*, Pearson, 2009.

2 Willard, H.H. *et al.*: *Instrumental Methods of Analysis*, 7th Ed. Wardsworth Publishing California, USA, 1988.

Christian, G.D, *Analytical Chemistry*, 6th Ed. John Wiley & Sons, New York, 2004.

4 Harris, D.C.: *Exploring Chemical Analysis*, 9th Ed. New York, W.H. Freeman, 2016.

5 Skoog, D.A. Holler F.J. & Nieman, T.A. *Principles of Instrumental Analysis, Saunder College Publications, (1998).*

6 Mikes, O. *Laboratory Hand Book of Chromatographic & Allied Methods*, Elles Harwood John Wiley 1979.

7 Ditts, R.V. Analytical Chemistry; Methods of separation, van Nostrand, 1974.

8 Khopkar, S. M., Basic Concepts of Analytical Chemistry, New Age (Second edition) 1998

9.Skoog D.A., Holler F.J., Nieman T.A., Principles of instrumental analysis, 5th Edn., Brooks & Cole (1997).

10.Atkins P, Overton T., Rourke J. Weller M. and Armstrong F *Shriver and Atkins. Inorganic Chemistry* Oxford University Press, Fifth Edition, 2012.

11. Adam, D.M. *Inorganic Solids: An introduction to concepts in solid-state structural chemistry.* John Wiley,1974.

12.Poole, C.P. & Owens, F.J. *Introduction to Nanotechnology* John Wiley 2003.

13.Rodger, G.E. *Inorganic and Solid State Chemistry*, Cengage Learning, 2002

CHE(H)-CC-XI ANALYTICAL AND MATERIALS CHEMISTRY LAB

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.

5.Synthesis of nano materials/porous materials (Sol-gel, hydrothermal, microwave). (Similarly other materials synthesis can be designed).

6.Analysis of XRD pattern of crystals.

7.Interpretation of FTIR, NMR and UV-Vis data of given material.

8.Estimation of particle size from the BET, SEM techniques.

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.

4.Published papers from various journals

Guidelines to the Paper Setter: The syllabus I Semester consists of analytical and materials chemistry
. The Semester question paper consists of 2 sections.

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 has to choose 2 question from each unit from **analytical and materials chemistry** 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-Paper-XI, Semester-IV

BLUE PRINT

CHE(H)-CC-XI ANALYTICAL AND MATERIALS CHEMISTRY

Sl. No	UNITS	Name of the chapter	10 Marks	5 Marks
1.	UNIT-I	Vibration spectroscopy UV-Visible spectrometry	2	2
2.	UNIT-II	Thermal analysis	2	1
3.	UNIT-III	Separation techniques	2	2
4.	UNIT-IV	Silica based materials	2	1
5.	UNIT-V	Nanomaterials	2	2

MODEL PAPER

B.Sc., DEGREE EXAMINATION

SEMESTER-IV

CHE(H)-CC-XI ANALYTICAL AND MATERIALS 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. Write the importance of isotope substitution
2. Explain basic principle of UV spectroscopy.
3. How to estimation of Ca and Mg from their mixture by usting thermogravimetry.
4. Explain extraction of metal ions from aqueous solution.
5. Write about development of chromatogram.
6. Explain the covalent organic frameworks.
7. Explain the synthesis and application of imidazolium.
8. Write about Carbon nanotubes.

PART- B 5X 10 = 50 Marks

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

9 (a). Explain about principles of instrumentation, sampling techniques of IR spectroscopy.

(or)

(b) How to determine the composition of metal complexes using Job's method of continuous variation and mole ratio method

10 (a)Explain theory of thermogravimetry and instrumentation .

(or)

(b). Explain about conductometric titrations

11.(a). What is Solvent extraction ? Explain principle and techniques of solventextraction .

(or)

(b). What is Chromatography? Explain Classification, principle and efficiency of chromatography.

(or)

12.(a). Explain silicalites and related microporous materials

(or)

(b). Write the Preparation of inorganic solids.

13.(a). Explain the Preparation of gold and silver metallic nanoparticles.

(or)

(b).Explain the following

(i) fibre-reinforced composites

(ii) applications of composites.

Chemistry for Physics Honours

P-I

Inorganic and General chemistry

Learning Objectives:

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

LO1.The elements in periodic table and their electronic configuration.

LO2.The shielding effect,Electronegativity and Ionization Enthalpy.
LO3.Heisenberg's uncertainity principle and Quantum numbers.
LO4. Semiconductors, Insulators.
LO5. Born-Haber cycle, Solvation energy, Resonance and resonance energy.
LO6. Bond moment and dipole moment, degree of ionization.

Course Outcomes:

After completion of the course students are able to learn about:
CO1. Slater rules and variation of effective nuclear charge in periodic table.
CO2. Schrodinger's wave equation.
CO3. Semiconductors, Insulators.
CO4. Fajan rules and polarization.
CO5. Solubility and solubility product

Inorganic and General chemistry(60H)

SYLLABUS

Unit-I :Periodicity of elements **15H**

Elements in Periodic table,Electronic configuration,Oxidation states, Formulas of acids,bases and salts.Periodic properties such as :

(g) Effective nuclear charge, shielding or screening effect, Slater rules, variation of effective nuclear charge in periodic table.
(h) Atomic radii (van der Waals)
(i) Ionic and crystal radii.
(j) Covalent radii (octahedral and tetrahedral)
(k) Ionization enthalpy, Successive ionization enthalpies and factors affecting ionization energy. Applications of ionization enthalpy.
(l) Electronegativity, Pauling's/ Mulliken's/ electronegativity scales. Variation of electronegativity with bond order, partial charge, hybridization.
General characteristics and electronic configuration of d-block and f-block elements.

Unit-II: Atomic Structure **11H**

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.

Unit-III: Metallic bonding and Weak chemical forces **10H**

Metallic Bond: Qualitative idea of free electron model,.

Weak Chemical Forces: Vander Waals, ion-dipole, dipole-dipole, induced dipole Semiconductors, Insulators dipole- induced dipole interactions hydrogen bond, effects of hydrogen bonding on melting and boiling points, solubility, dissolution.

Unit-IV: Chemical Bonding

12H

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

Covalent bond: Lewis structure, Valence Shell Electron Pair Repulsion Theory (VSEPR), Shapes of simple molecules and ions containing lone-and bond-pairs of electrons multiple bonding, sigma and pi-bond approach, Valence Bond theory, (Heitler-London approach). Hybridization containing s, p and s, p, d atomic orbitals, shapes of hybrid orbitals, Bents rule, Resonance and resonance energy. Covalent character in ionic compounds, polarizing power and polarizability. Fajan rules, polarization.

Ionic character in covalent compounds: Bond moment and dipole moment. Ionic character from dipole moment and electronegativities.

Unit-V: Ionic equilibria **12H**

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; dissociation constants of mono-, di- and tri-protic acids.

Salt hydrolysis, hydrolysis constants, degree of hydrolysis and pH for different salts. Buffer solutions; Henderson equation, buffer capacity, buffer range, buffer action, applications of buffers in analytical chemistry, Solubility and solubility product.
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.

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.

P-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

Unit-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.

Unit-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.

Unit-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.

Unit-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.

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

Dr. V. S. Krishna Govt. Degree & PG College (A)

(NAAC Reaccredited A Grade Institution & District Identified College)

CENTRE FOR RESEARCH STUDIES

Visakhapatnam- 530 013, Andhra Pradesh, INDIA

Department of Chemistry, External Examination List

Sl. No.	Name of the Faculty	Place of working	Contact number with email ID
01	Dr. S. Raju	Govt. Degree College Chodavaram-Visakha	9440306372
02	Smt. Ch. S. Anuradha	Govt. Degree College(W) Visakhapatnam	9885501503
03	Dr. A. Ramgopal	Govt. Degree College Paderu-Visakhapatnam	9441247706
04	Dr. A V Ramesh	SGA Govt. Degree College Yellamanchili-Visakhapatnam	8985646309
05	Dr. D. Laxman Rao	Govt. Degree College Saluru-VZM	9492451990
06	Sri. P. Kiran Kumar	SGA Govt. Degree College Yellamanchili-Visakhapatnam	9000251552
07	Smt. S. Durgabhavani	Govt. Degree College(W) Visakhapatnam	9441956233
08	Dr. VVJ Gopalakrishna	Mrs. AVN Degree College Visakhapatnam	9848312918
09	Smt. D. Suneetha	Govt. Degree College Yeleswaram. E.G	9492260511
10	Sri. V. Sambasivarao	Govt. Degree College TUNI, East Godavari	9440473002
11	Smt. Tejeswani	Govt. Degree College Nidadavole.W.G	
12	Smt. D. Prasanna	Govt. Degree College V.Madugula-Visakha	8332887645
13	Dr. Mamidi Gopi	Govt. Degree College Baruva. Srikakulam	7396927964
14	Dr. S. Ramakrishna	Govt. Degree College(Men), Srikakulam	9030768474
15	Smt. K. Vidyakalpana	SGA Govt. Degree College Yellamanchili-Visakhapatnam	6301682015
16	Dr. Saikrishna	Govt. Degree College(Men), Srikakulam	9542148008
17	Sri. T. Apparao	Govt. Degree College Chodavaram-Visakha	
18	Dr. G V Rao	Mrs. AVN Degree College Visakhapatnam	9440543909