Anekant Education Society's

TULJARAM CHATURCHAND COLLEGE
of Arts, Science and Commerce, BARAMATI
(AUTONOMOUS)

Department of Chemistry

CBCS Course Structure and Syllabus (2019 Pattern)

(to be implemented from June 2019)

Class	Semester	Course Code	Course Title	Course Type	No. of Credit
F Y B Sc	I	CHEM1101	Physical and Inorganic Chemistry- I	Theory	02
F Y B Sc	I	CHEM1102	Organic and Inorganic Chemistry- I	Theory	02
F Y B Sc	I	CHEM1103	Chemistry Practical- I	Practical	03
F Y B Sc	II	CHEM1201	Physical and Inorganic Chemistry II	Theory	02
F Y B Sc	II	CHEM1202	Organic and Inorganic Chemistry- II	Theory	02
F Y B Sc	II	CHEM1203	Chemistry Practical- II	Practical	03

CHEM1201: Physical and Inorganic Chemistry II (2 Credits, 36 L)

Course Objective

1. To introduce basic concepts in atomic structure such as, Bohr atomic model, energy level diagrams, hydrogen spectra etc.
2. To aware the basic of quantum chemistry its foundations and starting.
3. To develop knowledge of particle and wave nature of matter and uncertainty principle and its physical significance
4. To adequate students with basic concepts in thermodynamics and thermo chemical calculations
5. To develop knowledge about thermo chemistry and its applications.
6. To learn basic principle and concepts of theories of overlapping of atomic orbital's. Types of hybridizations involving s , p and d orbital's.
7. To understand the basic of VSEPR theory, bonding and shapes of simple molecules.

Course Outcome:

1. Apply theoretical approach to understand the structure of atom.
2. Describe foundation of quantum chemistry and its applications.
3. Identify different thermodynamic processes, its properties and intensive and extensive properties
4. Discuss the thermo chemistry of different processes and application of Hess's law in thermodynamics.
5. Explain the different types of bonding in a molecule and types of overlapping involving s, p, d, and f orbital's.
6. Identify types of hybridization and describe it with suitable example.
7. Apply the knowledge gained in the course to discuss and solve lab related queries.

SECTION I: PHYSICAL CHEMISTRY (24 L)

1. Atomic Structure: (12 L)

Introduction, atomic spectrum of hydrogen, Bohr model of hydrogen atom- derivation of atomic radius and energy, energy level diagram of hydrogen atom , Failure of Classical mechanics- blackbody radiation, photoelectric effect, electron diffraction, atomic spectra, quantization of energy, de Broglie's hypothesis, Heisenberg's uncertainty principle (without proof), wave equation, time independent Schrödinger equation, hydrogen atom (expressions only)., wave functions for s and patomic orbital's,

2. Chemical Thermodynamics: (12 L)

Definitions of thermodynamic terms: System, surroundings etc. Types of systems, intensive andextensive properties, State and path functions, Thermodynamic processes, concept of heat and work

First Law of Thermodynamics: Statement, definition of internal energy and enthalpy, Heat capacity, heat capacities at constant volume and pressure and their relationship, Joule's law –Joule-Thomson coefficient and inversion temperature. Calculation of w, q, dU & dH for the expansion of ideal gases under isotheral and adiabatic conditions for reversible process.

Thermo chemistry: Standard state, standard enthalpy of formation – Hess's Law

of heat summation and its applications, Heat of reaction at constant pressure and at constant volume, Enthalpy of neutralization, Bond dissociation energy and its calculation from thermo chemicaldata, temperature dependence of enthalpy, Kirchhoff's equation

SECTION II: INORGANIC CHEMISTRY (12 L)

1. Chemical Bonding and Structure: (3 L)

Recapitulation of bonds: Ionic, covalent, coordinate and metallic.
Types of overlaps: s-s. s-p ,p-p, p-d, d-d with examples, formation of sigma and pi bond. Theories of bonding: Valence bond theory, Heitler –London theory, Pauling Slater theory.

2. Concept of hybridization: (6 L)

Definition and need of hybridization, steps involved in hybridization ,explanation of covalency ofatom in the moles based on hybridization, types of hybridization involving in s, p and d orbital .

3. The VSEPR Theory: (3 L)

Introduction, need and assumptions of VSEPR theory, bonding and shapes of irregular moleculesas – ClF_3, BrF_3, Cl_2O, BrF_5, $TeCl_4$, XeO_3, $XeOF_4$, limitations of VSEPR theory.

References:

1. Physical Chemistry, P. W. Atkins, ELBS, 5th Edition.
2. Principles of Physical Chemistry, Maron and Prutton, 4th Edition.
3. Physical Chemistry, G. M. Barrow 4th Edition.
4. Quantum Chemistry, I. Levine, 5th Edition.
5. Essentials of Physical Chemistry, Bhal and Tuli,
6. Principles of Physical Chemistry, Puri, Sharma and Phathania
7. Mathematical Preparation of Physical Chemistry, F. Daniel, Mc Grow Hill.
8. Concise Inorganic Chemistry, J. D. Lee, 5th Edition
9. Concept and Models of Inorganic Chemistry, Douglas and Daniel, 3rd Edition
10. Inorganic Chemistry, James Hughey

Class: F.Y.B.Sc. (SEM I) **Subject**: Chemistry

Course: Physical and Inorganic Chemistry – II **Course Code**: CHEM 1201

Weightage: 1=weak or low relation,2=moderate or partial relation,3=strong or direct relation

Mapping of Course Outcomes with Program Outcomes

	PO1	**PO2**	**PO3**	**PO4**	**PO5**	**PO6**	**PO7**	**PO8**	**PO9**
CO1	3	0	0	0	0	0	0	0	0
CO2	0	3	0	0	0	0	0	0	0
CO3	0	0	3	0	0	0	0	0	0
CO4	0	0	0	3	0	0	0	0	0
CO5	0	0	0	0	3	0	0	0	0
CO6	0	0	0	0	0	3	0	0	0
CO7	0	0	0	0	0	0	3	0	0

Justification of Mapping

PO1: Disciplinary Knowledge:

CO1: Applying a theoretical approach to understand atomic structure showcases comprehensive subject knowledge (Strong Relation: 3)

PO2: Critical Thinking and Problem Solving:

CO2: Describing the foundation of quantum chemistry and its applications demonstrates critical thinking and analytical skills (Strong Relation: 3)

PO3: Social Competence:

CO3: Identifying different thermodynamic processes and their properties involves quantitative analysis and contributes to social competence by applying theoretical principles (Strong Relation: 3)

PO4: Research-Related Skills and Scientific Temper:

CO4: Discussing thermo chemistry and applying Hess's law in thermodynamics aligns with research-related skills and scientific temper in experimental analysis (Strong Relation: 3)

PO5: Trans-Disciplinary Knowledge:

CO5: Explaining different types of bonding in molecules and types of orbital overlapping demonstrates trans-disciplinary knowledge by integrating quantum concepts across disciplines (Strong Relation: 3)

PO6: Personal and Professional Competence:

CO6: Identifying types of hybridization and describing them with suitable examples showcases personal competence in understanding molecular structures (Strong Relation: 3)

PO7: Effective Citizenship and Ethics:

CO7: Applying gained knowledge to discuss and solve lab-related queries signifies commitment to effective lab practices and ethical conduct (Strong Relation: 3)

CHEM1202: Organic and Inorganic Chemistry II (2 Credits, 36 L)

Course Objective:

1. To understand concept of isomerism, types of isomers.
2. Students should know details about stereochemistry of acyclic molecule
3. To find R/S configuration in compounds containing one and two Chiral centers.
4. To use different reagents in organic synthesis.
5. To know silent features of periodic table with reference to P-block elements
6. To understand the structures of compounds and applications of P block elements.
7. Students know the applications of Interhalogen compounds

Course Outcome:

1. This course makes understanding of concept of isomerism, types of isomers.
2. Students should know details about stereochemistry of acyclic molecule.
3. Students are able to assign R/S configuration in compounds containing one Chiral centers.
4. Students are able to assign R/S configuration in compounds containing two chiral centers.
5. Students should know details about geometrical isomerism.
6. Students should know details about P- block elements.
7. Students know the symbols electronic configuration, trends and properties Structures of compounds.

SECTION I: ORGANIC CHEMISTRY (24 L)

1. Stereochemistry (12 L)

Concept of isomerism, types of isomers, representation of organic molecules (Projection formulae), conformational isomerism in alkanes (Ethane, propane and n-butane) with energy profile diagrams, Geometrical isomerism - Definition, conditions for geometrical isomers, physical and chemical properties, E/Z nomenclature of geometrical isomers, Optical isomers, chirality, optical isomerism with one asymmetric carbon atom, specific rotation, enantiomerism,R/S nomenclature R/S system nomenclature with wedge and Fischer representation of two chiralcentres, erythro, threo, meso-diastereomers with R/S configuration.

2. Reagents in Organic Synthesis (12 L)

Catalytic hydrogenation including liquid phase hydrogenation, Birch reduction, NaBH4, $LiAlH_4$,Sn/HCl, Oxidation reagents: $KMnO_4$, $K_2Cr_2O_7$, Jones reagent, PCC, per acids, OsO_4, synthesis and application of EAA and Malonic ester

SECTION II: INORGANIC CHEMISTRY (12 L)

1. Chemistry of P-Block Elements (12 L)

Position of elements in the periodic table, electronic configuration of elements, trends in properties like: atomic size, ionization potential, electro negativity, electron affinity, reactivity,oxidation state, anomalous behavior of first member of each group

Structure and Properties of - 1) Borates and Halides of Aluminum 2) Allotropes of Carbon 3)Oxyacids of Phosphorous and Sulphour 4) Interhalogen compounds

References:

1. Organic Chemistry-. Morrison and Boyd, 6th edition, prentice hall, 2001.
2. Stereochemistry of carbon compounds - E. L. Eliel
3. Reactions, rearrangements and reagents – S N Sanyal
4. Inorganic Chemistry-James Hughey
5. General Chemistry - Raymond Chang
6. Concise Inorganic Chemistry-J.D. Lee, 5th Edition-Relevant pages.
7. Concept & model of Inorganic Chemistry-Douglas Mc Daniels, 3rd edition.

Class: F.Y.B.Sc. (SEM I) **Subject**: Chemistry

Course: Organic and Inorganic Chemistry II **Course Code**: CHEM 1202

Weightage: 1=weak or low relation, 2=moderateorpartialrelation,3=strong or direct relation

Mapping of Course Outcomes with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	0	0	0	0	0	0	0	0
CO2	0	3	0	0	0	0	0	0	0
CO3	0	0	3	0	0	0	0	0	0
CO4	0	0	0	3	0	0	0	0	0
CO5	0	0	0	0	3	0	0	0	0
CO6	0	0	0	0	0	3	0	0	0
CO7	0	0	0	0	0	0	3	0	0

Justification of Mapping

PO1: Disciplinary Knowledge:

CO1: Understanding the concept of isomerism aligns with comprehensive subject knowledge (Strong Relation: 3)

PO2: Critical Thinking and Problem Solving:

CO2: Knowing the details about stereochemistry showcases critical thinking and analytical skills (Strong Relation: 3)

PO3: Social Competence:

CO3: Ability to assign R/S configurations in chiral compounds demonstrates a qualitative and quantitative approach, contributing to social competence (Strong Relation: 3)

PO4: Research-Related Skills and Scientific Temper:

CO4: Assigning R/S configurations in compounds with multiple chiral centers showcases research-related skills and scientific temper (Strong Relation: 3)

PO5: Trans-Disciplinary Knowledge:

CO5: Understanding details about geometrical isomerism demonstrates trans-disciplinary knowledge across chemical concepts (Strong Relation: 3)

PO6: Personal and Professional Competence:

CO6: Knowing details about P-block elements signifies personal competence in understanding periodic trends (Strong Relation: 3)

PO7: Effective Citizenship and Ethics:

CO7: Knowledge about S block elements shows an understanding of broader chemical principles, contributing to ethical and accurate chemical practices (Strong Relation: 3)

CHEM1203: Chemistry Practical Course (12 P, 4 Credits)

Course Objectives:

1. To introduce chemical and laboratory safety.
2. To adequate students with graph of various functions.
3. To learn basic of chemistry practical from all the discipline of chemistry
4. To learn the estimation of compounds.
5. To know the synthesis of derivatives.
6. To learn the volumetric analysis.
7. To know the preparation of solutions.

Course Outcomes

1. Students will be able to apply mathematical knowledge in graphical representation of experimental data.
2. Students will able to develop experimental and operational skills through hands on training showcasing accident free working, critical thinking and numerical solving ability in laboratory.
3. Students will able to prepare the organic derivatives.
4. Students should able to develop the ability of standard solution preparation required in chemical synthesis or analysis with qualitative or quantitative approach.
5. Students should able to estimate the organic compounds volumetrically
6. Students should able to develop to use different reagents in organic qualitative analysis.
7. Students will able to apply experimental knowledge in future research approach to improve the personal and professional ability

1. Physical Chemistry (Minimum 4 experiments)

1. Plot the graph of following functions using excel / graph paper-
   a) Linear function b) Exponential function c) Logarithmic function
2. Determine the ionization potential of hydrogen atom using hydrogen spectrum.
3. Determine the relative viscosity of given organic liquids by viscometer.
4. Determine ΔH and ΔS for the following chemical reactions

   $3Mg_{(s)} + 2\ FeCl_{3\,(aq)} \rightarrow 2\ Fe_{(s)} + 3\ MgCl_{2\,(aq)}$
5. Determine the heat of solution of NH_4Cl

2. Inorganic Chemistry (Minimum 4 experiments)

1. Analysis of mixed alkali by volumetric method.
2. Determine the number of water molecules of $BaCl_2.2H_2O$/ $MgSO_4.7H_2O$.
3. Standardization of NaOH solution and find the strength of given HCl solution.

4. Inorganic Qualitative analysis (Four mixtures without phosphate and borate)

3. Organic Chemistry (Minimum 4 experiments)

1.Determine amount of aspirin in APC tablet volumetrically.

2.Techniques: (Micro scale)

i. Crystallization ii. Sublimation iii. Thin layer chromatography

3.Organic Qualitative analysis of single compound (at least one compound in each type):Type, Preliminary tests, and Physical constant

References:

1.Senior Practical physical chemistry, Khosala and Garg.

2.Experiments in Chemistry, D.V. Jahagirdar.

3.Textbook of qualitative analysis, A. I. Vogel 4th Edition

4. Textbook of practical organic chemistry, A .I. Vogel.

Class: F.Y.B.Sc. (SEM I) **Subject**: Chemistry
Course: Chemistry Practicals **Course Code**: CHEM 1203

Weightage: 1=weakorlowrelation,2=moderateorpartialrelation,3=strongordirectrelation

Mapping of Course Outcomes with Program Outcomes

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9
CO1	3	0	0	0	0	0	0	0	0
CO2	0	3	0	0	0	0	0	0	0
CO3	0	0	3	0	0	0	0	0	0
CO4	0	0	0	3	0	0	0	0	0
CO5	0	0	0	0	3	0	0	0	0
CO6	0	0	0	0	0	3	0	0	0
CO7	0	0	0	0	0	0	3	0	0

Justification of Mapping

PO1: Disciplinary Knowledge:

CO1: Applying mathematical knowledge in graphical representation aligns with comprehensive understanding (Strong Relation:)

PO2: Critical Thinking and Problem Solving:

CO2: Developing experimental skills with critical thinking and problem-solving abilities (Strong Relation: 3)

PO3: Social Competence:

CO3: Preparing organic derivatives requires a qualitative and quantitative approach, contributing to social competence (Strong Relation: 3)

PO4: Research-Related Skills and Scientific Temper

CO4: Developing the ability to prepare standard solutions showcases research-related skills and scientific temper (Strong Relation: 3)

PO5: Trans-Disciplinary Knowledge:

CO5: Estimating organic compounds volumetrically showcases trans-disciplinary knowledge across chemical concepts (Strong Relation: 3)

PO6: Personal and Professional Competence:

CO6: Using different reagents in organic qualitative analysis enhances personal competence in laboratory skills (Strong Relation: 3)

PO7: Effective Citizenship and Ethics:

CO7: Applying experimental knowledge to future research contributes to ethical scientific practices.