



## **JAI HIND COLLEGE**

Basantsing Institute of Science & J. T. Lalvani College of Commerce.

and Sheila Gopal Raheja College of Management

Affiliated to University of Mumbai  
**Autonomous**

**Bachelor of Science (B.Sc in Chemistry)**

## SEMESTER I

<b>Course Code : SCHE101</b>	<b>Course Title : Concepts of Physical and Inorganic</b>
------------------------------	--

### **Learning Objectives:**

1. To train the fundamental concepts of thermodynamics: inter - relationships of variables and their practical applications through problem solving
2. To impart knowledge on kinetics of various reactions: parameters involved, determination of order by various methodologies and practical applications
3. To inculcate knowledge on the basics of atomic structure using quantum mechanics: shapes of orbital

### **Learning Outcome:**

1. Use concepts of thermodynamics and is able to apply in deriving relationship between thermodynamic variables
2. Interpret experimental results for determination of reaction order.
3. Summarize the concepts of nodes and the shapes of the orbital with correct signs of wave functions.

## SEMESTER I

<b>Course Code : SCHE102</b>	<b>Course Title : Concepts of Organic and Inorganic Chemistry-I</b>
------------------------------	---

### **Learning Objectives:**

1. To train the students to correlate the systematic name with the structure of organic compound; differentiate and rationalize the bond strength, bond dissociation and therefore, reactivity of different classes of organic compounds
2. To inculcate knowledge on the different parameters of stereo-electronic effects in organic reactions
3. To impart knowledge about chemical properties of elements with their position in the periodic table

### **Learning Outcomes:**

1. Account for acidity and basicity in organic compounds based on stereo-electronic effects.
2. Summarize the effects in organic chemistry to account for experimental observations as well as to make prediction of reaction outcomes for new reactions.
3. Use the chemical properties of elements based on parameters with predictable trends across periods and groups in periodic table.

## SEMESTER I

<b>Course Code : SCHE1PR</b>	<b>Course Title : Practical Coursework in Chemistry-I</b>
------------------------------	---

### **Learning Objectives:**

1. To impart knowledge in determining the order of reaction; measurement of enthalpy
2. To train students with numerical problems based on basic concepts involving quantitative analysis
3. To make the students understand about the concept of solubility product and pH in the formation of a precipitate in semi micro analysis.

### **Learning Outcomes:**

1. Design experiments to measure change in enthalpy on dissolution of ionic compounds in water
2. Deduce the concentrations of chemicals based on titrimetric analysis.
3. Summarize the qualitative presence of ions in a sample by various tests and can extrapolate the tests to commercial samples for analysis.

## SEMESTER II

<b>Course Code : SCHE201</b>	<b>Course Title : Concepts of Physical and Inorganic Chemistry - II</b>
------------------------------	---

### **Learning Objectives:**

1. To train the students to understand the theoretical principles of the states of matter, their properties and various applications
2. To impart knowledge on the concept of ionic equilibria, pH, theory of ionic products, theory of acids and bases, theory of indicators, solubility product & their practical applications
3. To help students to understand the formation of chemical bonds, rules governing them, their types and the spatial arrangements leading to various molecular symmetries.

### **Learning Outcomes:**

1. Use knowledge of the various states of matter, the theoretical principles governing each state, determination of physical parameters and their practical applications.
2. Implement knowledge on ionic equilibria, the theory and applications of electrolytes, theory of acids and bases and sparingly soluble salts.
3. Utilize information formation of bonds between various types of atoms thereby leading to the formation of various molecular entities, their geometrical arrangements and the rules governing them.

## SEMESTER II

<b>Course Code : SCHE202</b>	<b>Course Title : Concepts of Organic and Inorganic Chemistry-II</b>
------------------------------	--

### **Learning Objectives:**

1. To train students to enlist different reactive intermediates and compare their relative stabilities
2. To make the students aware about the parameters required for aromaticity
3. To train the students to correlate the orienting influence of a group in electrophilic aromatic substitution with electron density

### **Learning Outcomes:**

1. Analyse the stability of a given reactive intermediate

2. Predict the products of electrophilic aromatic substitution based on orienting influence of a group.
3. Recount the methods of preparation and apply it to reactions of alkanes and its oxygenated derivatives

### **SEMESTER II**

<b>Course Code : SCHE2PR</b>	<b>Course Title : Practical Coursework in Chemistry-II</b>
------------------------------	--

#### **Learning Objectives:**

1. To train students to develop the skill of observation, understanding and analysis of data
2. to make an understanding to apply the concept of indicators in determining the pH and strengths of solutions
3. To make students aware about estimate analytes through volumetric analysis by performing acid- base and redox titrations.

#### **Learning Outcomes:**

1. Implement knowledge to make choice of the correct indicator to be used for an acid-base titration.
2. Use knowledge in processing the techniques involved in volumetric analysis and at the end of the experiment be able to understand concepts of accuracy and precision of measurement.
3. Develop the requisite skills involved in gravimetric analysis and will also be acquainted with the SOP of an analytical balance.

### SEMESTER III

<b>Course Code : SCHE301</b>	<b>Course Title : Principles of Physical &amp; Analytical Chemistry I</b>
------------------------------	---

#### **Learning Objectives:**

1. To make students aware about the theoretical principles of thermodynamics and its various applications
2. To make students to understand the concept of conductivity including its measurement
3. To train students with concepts involved in electrolytic cells and their applications.

#### **Learning Outcomes:**

1. Applying the concepts of thermodynamics to spontaneity of reaction and predict the direction of movement of reaction based on the chemical potential.
2. Use concept and infer from the conductance measurements of solutions and the factors affecting conductivity.
3. Extrapolate the learning of electrolytic cells to industrial processes involving purification of metals, electroplating etc.

### SEMESTER III

<b>Course Code : SCHE302</b>	<b>Course Title : Principles of Inorganic Chemistry I</b>
------------------------------	---

#### **Learning Objectives:**

1. To make students to understand the principles of chemical bonding and the fundamental concepts of hybridization and resonance
2. To train the students to have an in-depth understanding of wave mechanical principles of VBT and MOT
3. To make them aware about the physical and chemical properties of some Important compounds of group 13, 14 and 15

#### **Learning Outcomes:** \

1. Explain experimental observations based on the bonding theories and also are able to make prediction of various experimental observables
2. Correlate abstract wave mechanical principles to account for various experimental observations
3. Summarize with a range of dynamic physical and chemical properties of p block elements

### SEMESTER III

<b>Course Code : SCHE303</b>	<b>Course Title : Principles of Organic Chemistry -I</b>
------------------------------	--

#### **Learning Objectives:**

1. To make students aware about the reactions of halogenated and oxygenated organic compounds of aliphatic and aromatic hydrocarbons
2. To inculcate knowledge in predicting the reactivity and stereochemistry of halogenated and oxygenated organic compounds
3. To equip the students with a thorough knowledge of the theory of organic polymers and their applications

#### **Learning Outcomes:**

1. Link the spot tests for various functional groups done in the laboratory with the characteristic reactions of functional groups.
2. Use knowledge to understand thoroughly with the structures of various organic polymers and their properties & functions in day to day life.
3. Apply knowledge in the reactions of carbonyl compounds towards synthesis of commercially important compounds using the rich carbonyl chemistry

### SEMESTER III

<b>Course Code : SCHE3PR</b>	<b>Course Title : Practical Course work in Chemistry-III</b>
------------------------------	--

#### **Learning Objectives:**

1. To make students understand the application of measurement of conductance for weak electrolytes
2. To train students to learn the handling of photometer for colored solutions
3. To make them aware about formation of precipitate under different pH conditions

#### **Learning Outcomes:**

1. Correlate the values of conductance with the strength of electrolytes and also use conductivity measurements for titrimetric analysis.
2. Handle basic analytical instruments independently.
3. Set up one step organic reactions including calculations for theoretical and percentage yields, and purification technique of recrystallisation used in organic chemistry.

## SEMESTER IV

<b>Course Code : SCHE401</b>	<b>Course Title : Principles of Physical &amp; Analytical Chemistry- II</b>
------------------------------	---

### **Learning Objectives:**

1. To make students learn different types of liquid mixtures and their methods of separation.
2. To train the students in understanding the applications of Phase Rule to one, two and three component systems.
3. To make the students learn characteristic features of cubic crystal lattice in detail.

### **Learning Outcomes:**

1. Apply the theoretical principles in effecting separation of components from a solution.
2. Correlate the phase diagrams with the phase equilibria observed in day to day events.
3. Use the knowledge of catalyst and will be able to choose a catalyst for a chemical reaction based on its role.

## SEMESTER IV

<b>Course Code : SCHE402</b>	<b>Course Title : Principles of Inorganic Chemistry II</b>
------------------------------	--

### **Learning Objectives:**

1. To make students to understand the properties of transition elements and their complexes
2. To train students to correlate the properties of transition metal complexes with their applications.
3. To inculcate knowledge in understanding the properties of the compounds of group 15 & group 18 elements.

### **Learning Outcomes:**

1. Implement the knowledge of the properties of transition elements and their complexes used as reagents in a chemical laboratory
2. Correlate the formation of colored complexes as a diagnostic tool in qualitative analyzes.
3. Extrapolate the properties of p-block elements depending the group to which they belong



## SEMESTER IV

<b>Course Code : SCHE403</b>	<b>Course Title : Principles of Organic Chemistry II</b>
------------------------------	--

### **Learning Objectives:**

1. To make the understand about mechanism of reactions of carboxylic and sulphonic acids and their derivatives
2. To impart knowledge in comparing the acidity of carboxylic and sulphonic acids and their substituted derivatives
3. To train students to reproduce the chemistry of nitrogen containing organic compounds such as aromatic nitro compounds and aromatic and aliphatic amino Compounds

### **Learning Outcomes:**

1. Analyse the mechanism of the reaction of acid functional group and suitably be able to maintain conditions to optimize the reaction.
2. Infer the correlations between the acidity of carboxylic and sulfonic acid with the reagents used for their chemical separations in the laboratory.
3. Use the knowledge of nitrogen containing functional groups and their interconversions for application in a synthetic pathway.

## SEMESTER IV

<b>Course Code : SCHE4PR</b>	<b>Course Title : Practical Course work in Chemistry-IV</b>
------------------------------	---

### **Learning Objectives:**

1. To equipped students with techniques of Extraction of Fe(III) from aqueous medium and determine the distribution ratio and extraction efficiency.
2. To train students with Inorganic Preparations Trisethylenediaminenickel (II) thiosulphate Quantatitative
3. To train the students to Separation of binary mixture (Chemical Separation)
  - a. Solid-solid binary mixture (Water insoluble-water insoluble)

### **Learning Outcomes:**

1. Use with techniques of Extraction of Fe(III) from aqueous medium and determine the distribution ratio and extraction efficiency.
2. Perform the method with Inorganic Preparations Trisethylenediaminenickel (II) thiosulphate Quantatitative
3. Separate binary mixture (Chemical Separation) Solid-solid binary mixture (Water insoluble-water insoluble)

## SEMESTER V

<b>Course Code : SCHE501</b>	<b>Course Title : Advanced Physical Chemistry - I</b>
------------------------------	---

### **Learning Objectives:**

1. To make students to understand the theoretical concept of molecular spectroscopy  
Differentiate between different types of molecular spectroscopy
2. To train students about the various colligative properties of solutions and to determine molecular weight using this property
3. To impart knowledge in the principles and properties of thermodynamics and kinetics

### **Learning Outcomes:**

1. Use theoretical principles underlying spectroscopic techniques for applications in structure elucidation.
2. Design experiments which measure changes in colligative properties for determination of molecular weight of analyte.
3. Apply the concepts of adsorption for determination of surface area of porous adsorbate material.

## SEMESTER V

<b>Course Code : SCHE502</b>	<b>Course Title : Advanced Inorganic Chemistry - I</b>
------------------------------	--

### **Learning Objectives:**

1. To train students to apply various symmetry operations and to recognize the optical activity phenomenon through them
2. To make the students to understand about solid state synthesis and the properties of some important solid state materials such as high temperature superconductors
3. To impart knowledge about the basic trend of f-block elements along with its extraction and uses

### **Learning Outcomes:**

1. Correlate the symmetry to the spectroscopic signatures of the molecule.
2. Use large number of inorganic materials which find application in electronics & is also equipped with the knowledge of industrial process underlying their synthesis.
3. Analyse and predict properties of rare earth elements, their significance and applications.

#### **SEMESTER V**

<b>Course Code : SCHE503</b>	<b>Course Title : Advanced Organic Chemistry - I</b>
------------------------------	--

#### **Learning Objectives:**

1. To make them understand the mechanism of varied organic reactions
2. To help students to visualize the stereo chemical features of organic compounds
3. To train students with name the organic compounds on the basis of IUPAC rules

#### **Learning Outcomes:**

1. Predict the outcome (stereochemistry, regioselectivity) of a chemical reaction of a structure based on the mechanistic pathway followed.
2. Interpret the strain in molecules with respect to characteristic stereochemical attributes of a system.
3. Apply the reactions involving metals in organic synthesis of commercially important products.

#### **SEMESTER V**

<b>Course Code : SCHE504</b>	<b>Course Title : Advanced Analytical Chemistry - I</b>
------------------------------	---

1. To make students aware about basic knowledge and understanding of core principles of analytical chemistry

2. To equipped the students with basic analytical techniques and practical aspects of classical chemical analysis
3. To inculcate knowledge to introduce stakeholders to various modern instrumental methods of analysis and separation techniques

**Learning Outcomes:**

1. Use knowledge of different classes of chemical analysis and is capable of making a choice of a method based on various practical aspects of analysis.
2. Correlating the number of extractions with extraction efficiency and is able to put it to practice in experiment
3. Design experiments for analysis based on specific interactions of analyte.

**SEMESTER V**

<b>Course Code : SCHE5PR1</b>	<b>Course Title : Practical Course work in Physical and Inorganic Chemistry - I</b>
-------------------------------	---

**Learning Objectives:**

1. To make students aware about the method of determination of rate constant conductometrically
2. To inculcate knowledge about electrochemical cells in determination of  $k_{sp}$
3. To make them understand about experimental determination of isoelectric point using pH metry

**Learning Outcomes:**

1. Analyse the method of determination of rate constant conductometrically
2. Use knowledge about electrochemical cells in determination of  $k_{sp}$
3. Explain about experimental determination of isoelectric point using pH metry

**SEMESTER V**

<b>Course Code : SCHE5PR2</b>	<b>Course Title : Practical Course work in Organic and Analytical Chemistry - I</b>
-------------------------------	---

**Learning Objectives:**

1. To train students to identify the nature of the components of a binary mixture
2. To train students to separate the components of a binary mixture by chemical/physical method
3. To make students aware about purifying the components of binary mixture by recrystallization

**Learning Outcomes:**

1. Identify the nature of the components of a binary mixture
2. Separate the components of a binary mixture by chemical/physical method
3. Purify the components of binary mixture by recrystallization

**SEMESTER V**

<b>Course Code : SCHE5AC</b>	<b>Course Title : Pharmaceutical Chemistry and Paints &amp; Pigments -I</b>
----------------------------------	---

**Learning Objectives:**

- 1.To acquaint the students with different terms associated with medicinal chemistry, and their significance
- 2.To make them understand the pharmacokinetics and pharmacodynamics of a given drug molecule
- 3.To train the students to recollect various pharmacodynamic agents used for varied systemic disorders

**Learning Outcomes:**

- 1.associate with basic terms involved in medicinal chemistry and pharmacy.
- 2.apply the drug-receptor interactions to characteristic class of drugs, its dosage form and dose frequency
3. predict the brightness of colour of dyes based on the theories of colour for its suitable application.

**SEMESTER V**

<b>Course Code : SCHE5ACPR</b>	<b>Course Title : Practical Course Work in Pharmaceutical Chemistry, Paints &amp; Pigments -I</b>
------------------------------------	---

**Learning Objectives:**

1. To equipped them with preparing drug intermediates/drugs/dye intermediates on a bench scale
2. To develop an understanding on estimating the concentration of drugs in a given sample, quantitatively
3. To train students to develop the skill of separation of the components of a natural pigment using paper chromatography

**Learning Outcomes:**

1. Prepare drug intermediates/drugs/dye intermediates on a bench scale
2. Use knowledge on the concentration of drugs in a given sample, quantitatively
3. Use the skill of separation of the components of a natural pigment using paper chromatography

## SEMESTER VI

<b>Course Code : SCHE601</b>	<b>Course Title : Advanced Physical Chemistry - II</b>
------------------------------	--

### **Learning Objective:**

1. To make them understand Lewis concept of activity and activity coefficient of an electrolyte and its expressions for various types of electrolytes.
2. To train them to learn the concept of overvoltage and understand method of its determination using Tafel's theory.
3. To develop an understanding of polymers its classification and various method of determination of its molecular weight.

### **Learning Outcomes:**

1. Use Lewis concept of activity and activity coefficient of an electrolyte and its expressions for various types of electrolytes.
2. Analyse the concept of overvoltage and understand the method of its determination using Tafel's theory.
3. Implement knowledge of polymers its classification and various method of determination of its molecular weight.

## SEMESTER VI

<b>Course Code : SCHE602</b>	<b>Course Title : Advanced Inorganic Chemistry - II</b>
------------------------------	---

### **Learning Objectives:**

1. To train understand how the transition metals splits the d-orbital in presence of ligand field.
2. To make them understand the MOT of the complexes of transition elements with octahedral geometry.
3. To inculcate knowledge on a systematic introductory treatment of organometallic compounds, emphasising synthesis, properties, structure and reactivity.

**Learning Outcome**

1. Categorize the inorganic elements according to their roles in the biological system and identify the general aspects of storage and transport of metal-ions.
2. Draw MOTs of the complexes with different ligand field.
3. Analyse the reactivity of organometallic compounds including their application in synthesis.

**SEMESTER VI**

<b>Course Code : SCHE603</b>	<b>Course Title : Organic Chemistry - II</b>
------------------------------	--

**Learning Objectives:**

1. To make them understand the stereochemical implications of organic reactions
2. To train them to write the uses of catalysts and reagents in different organic reactions
3. To train them with the chemistry of biomolecules

**Learning Outcomes:**

1. Predict the stereochemical outcome of an organic reaction based on its mechanism
2. Use the specific applications of different catalysts and reagents in organic reaction
3. To draw a logical conclusion between the structure of natural products and its reactions

**SEMESTER VI**

<b>Course Code : SCHE604</b>	<b>Course Title : Advanced Analytical Chemistry - II</b>
------------------------------	--

**Learning Objectives:**

1. To inculcate knowledge to understand difference between potentiometry and voltammetry.
2. To train them to learn different methods of quantification of polarographic techniques.
3. To make them aware about comparative study of Gas solid chromatography and Gas Liquid Chromatography.



**Learning Outcomes:**

1. Use electroanalytical techniques such as Polarography and amperometry.
2. Analyse various chromatographic methods of separation such as Gas Chromatography and Ion exchange chromatography along with their applications.
3. Use methods of determination of food constituents, methods of preservations etc.

**SEMESTER VI**

<b>Course Code : SCHE6PR1</b>	<b>Course Title : Practical Course work in Physical and Inorganic Chemistry - II</b>
-------------------------------	--

**Learning Objectives:**

1. To train them to learn the calculation of order of reaction graphically from given data.
2. To encourage them understand the calculation of number of electrons from redox reaction.
3. To impart knowledge on the estimated amount of acid present in mixture of acid from conductance measurements.

**Learning Outcomes:**

1. analyse the calculation of order of reaction graphically from given data.
2. Solve the calculation of number of electrons from redox reaction.
3. Use knowledge on the estimated amount of acid present in mixture of acid from conductance measurements.

**SEMESTER VI**

<b>Course Code : SCHE6PR2</b>	<b>Course Title : Practical Course work in Organic and Analytical Chemistry - II</b>
-------------------------------	--

**Learning Objectives:**

- 1.To train them to identify the nature of the components of a binary mixture

2. To make them aware about separate the components of a binary mixture by chemical/physical method

3. To train them to purify the components of binary mixture by recrystallization/distillation

**Learning Outcomes:**

1. Identify the nature of the components of a binary mixture

2. Separate the components of a binary mixture by chemical/physical method

3. Purify the components of binary mixture by recrystallization/distillation

**SEMESTER VI**

<b>Course Code : SCHE6AC</b>	<b>Course Title : Pharmaceutical Chemistry and Paints &amp; Pigments -II</b>
------------------------------	--

**Learning Objectives:**

1. To make them understand the different parameters associated with drug discovery, design and development

2. To impart knowledge on different classes of chemotherapeutic drugs; their uses and side effects

3. To make them aware about some common drugs and drug intermediates

**Learning Outcomes:**

1. Differentiate different parameters associated with drug discovery, design and development

2. Classify different classes of chemotherapeutic drugs; their uses and side effects

3. Identify some common drugs and drug intermediates

**SEMESTER VI**

<b>Course Code : SCHE6ACPR</b>	<b>Course Title : Practical Course Work in Pharmaceutical Chemistry, Paints &amp; Pigments</b>
------------------------------------	--

**Learning Objectives:**

1. To train them to prepare dye intermediates on a bench scale
2. To impart knowledge to estimate the concentration of drugs in a given sample, quantitatively
3. To make them understand the significance of monograph

**Learning Outcomes:**

1. Prepare dye intermediates on a bench scale
2. Estimate the concentration of drugs in a given sample, quantitatively
3. Use knowledge to analyse the significance of monograph