



**C. U. SHAH UNIVERSITY**



**C. U. SHAH UNIVERSITY  
WADHWAN CITY  
FACULTY OF SCIENCES**

**B.Sc.**

**SEM-IV**

**Syllabi (CBCS) of  
Chemistry  
WEF June 2016**



**FACULTY OF SCIENCES**  
**DEPARTMENT OF CHEMISTRY**

**COURSE: B.Sc.**

**SEMESTER: IV**

**SUBJECT NAME: Organic Chemistry-II**

**SUBJECT CODE: 4SC04OCH1**

**Teaching & Evaluation Scheme:-**

Teaching hours/week				Credit	Evaluation Scheme/semester							
Th	Tu	Pr	Total		Theory				Practical		Total Marks	
					Sessional Exam		University Exam		Internal			University
					Marks	Hrs	Marks	Hrs	Pr	TW		
3	0	0	3	3	30	1.5	70	3	--	--	--	100

**Objectives:-**

- To learn about organic name reactions and their reaction mechanisms.
- To understand name rearrangement actions.
- To understand importance of drugs, dyes, alkaloids and terpenoids.

**Prerequisites:-**

- Before learning organic chemistry, student should aware about basic principles and theories of organic chemistry, drugs, dyes, natural compounds and other 10+2 level chemistry.

**Course outline:-**

Sr. No.	Course Contents
1	<b>Name reactions and rearrangement</b> Mechanism and applications of Arndt-Eistert reaction, Barbier-Wieland reaction, Grignard reaction, Kolbe synthesis, Michael addition, Mannich reaction, Wurtz reaction, Beckmann rearrangement, Hoffmann rearrangement, Curtius rearrangement, Fries rearrangement.
2	<b>Drugs and Dyes</b> <b>Drugs:</b> Introduction, classification by structure and methods of application, synthesis and uses of methyl orange, congo red, malachite green, alizarin and indigo. <b>Dyes:</b> Introduction to drugs, classification of drugs, synthesis and application of ibuprofen, atenolol and adrenaline.



<b>3</b>	<b>Alkanoids and Terpenoids</b> <b>Alkanoids:</b> Introduction, classification, occurrence and isolation of alkaloids, structure determination of alkaloids, constitution and properties of conine and nicotine. <b>Terpenoids:</b> Introduction to terpenes, isoprene rule, classification, constitution and synthesis of citral and menthol.
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### Learning Outcomes:-

After the successful completion of the course, students will be able to

- Understand organic reactions and mechanisms.
- Explore study of natural products, dyes, drugs etc.

### Books Recommended:-

1. 'Organic Chemistry, The fundamental principles', **I. L. Finar**, *Pearson*.
2. 'Organic Chemistry, Stereochemistry and the chemistry Natural Products', **I. L. Finar**, *Pearson*.
3. 'Organic Chemistry', **S. M. Mukherji, S. P. Singh and R. P. Kapoor**, *New Age International (P) Limited*.
4. 'A textbook of organic chemistry', **Arun Bahl, B. S. Bahl**, *S. Chand*.
5. 'Organic Chemistry', **Robert Thornton Morrison and Robert Neilson Boyd**, *Prentice-Hall of India Private Limited*.
6. 'March's Advanced Organic Chemistry Reactions, Mechanism and Structure', **Michael B Smith and Jerry March**, *Wiley*.
7. 'Reaction Mechanisms and Reagents in Organic Chemistry', **Gurudeep R. Chatwal**,
8. 'Organic chemistry, reaction mechanism', **V. K. Ahluvalia, R. K. Parashar**, *Narosa*.

### E-Resources:

1. <http://www.organic-chemistry.org/>
2. [www.peoi.org/Courses/Coursesen/chem/fram16.html](http://www.peoi.org/Courses/Coursesen/chem/fram16.html)
3. [http://www.organicdivision.org/?nd=p\\_organic\\_web\\_links](http://www.organicdivision.org/?nd=p_organic_web_links)
4. <https://en.wikipedia.org/wiki/Alkaloid>
5. [www.epharmacognosy.com/2012/07/terpenoid-alkaloids.html](http://www.epharmacognosy.com/2012/07/terpenoid-alkaloids.html)
6. <http://www.masterorganicchemistry.com/resource-guide/>
7. <http://orgchem.iisc.ernet.in/chemlink.html>
8. [http://www.mpcfaculty.net/ron\\_rinehart/organic.htm](http://www.mpcfaculty.net/ron_rinehart/organic.htm)
9. <http://web.usca.edu/chemistry/NewStudentInfo/helpful-websites-for-studying-organic-chemistry.dot>
10. <http://pubs.rsc.org/en/journals/journalissues/oc#!recentarticles&all>
11. <http://www.chem.ox.ac.uk/vrchemistry/iom/#>
12. <http://ocw.mit.edu/courses/#chemistry>



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**FACULTY OF SCIENCES**

**DEPARTMENT OF CHEMISTRY**

**COURSE: B.Sc.**

**SEMESTER: IV**

**SUBJECT NAME: Inorganic Chemistry-II**

**SUBJECT CODE: 4SC04ICH1**

**Teaching & Evaluation Scheme:-**

Teaching hours/week				Credit	Evaluation Scheme/semester							
Th	Tu	Pr	Total		Theory				Practical			Total Marks
					Sessional Exam		University Exam		Internal		University	
					Marks	Hrs	Marks	Hrs	Pr	TW		
3	0	0	3	3	30	1.5	70	3	--	--	--	100

**Objectives:-**

- To understand the structure, IUPAC nomenclature and theory related to coordination compounds.
- To learn the preparation, properties and structure of Organometallic compounds.
- To learn basic postulates of wave mechanics.
- To study the chemistry of d-block elements.

**Prerequisites:-**

- Before studying Inorganic chemistry, all students have basic knowledge of wave mechanics, structure and bonding in inorganic compounds and knowledge related to 10+2 level chemistry.



## Course outline:-

Sr. No.	Course Contents
1	<p><b>Coordination compounds:</b> General concepts and brief explanation of coordination compounds, classification of ligands, terminology in coordination compounds and IUPAC nomenclature, isomerism in coordination compounds: Postulates of Werner's coordination theory, explanation of the structure of Co(III) amines and Pt(IV) complexes on the basis of Werner's coordination theory, experimental evidences in favour of Werner's theory, Sidgwick's electronic concept of coordinate bond and its limitations, Sidgwick's effective atomic number rule, structural isomerism: conformation isomerism, Ionization isomerism, hydrate isomerism, coordination isomerism, linkage isomerism, coordination position isomerism, ligand isomerism and polymerization isomerism, Stereoisomerism: Geometrical isomerism, Geometrical isomerism in 4-coordinated complex compounds, Geometrical isomerism in 6-coordinated complex compounds, to distinguish between cis and trans isomers, optical isomerism: definitions, conditions for a molecule to show optical isomerism, optical isomerism in 4-coordinated complex compounds, optical isomerism in 6-coordinated complex compounds.</p>
2	<p><b>A) Wave –Mechanics:</b> Basic postulates of quantum mechanics (Postulates 1, 2, 3 and 4), Operators: their addition, subtraction and multiplication, commutators, particle in a box (one dimensional), zero potential energy, characteristics of the wave functions, electron in a ring.</p> <p><b>B) Organo-metallic Compounds:</b> Introduction, classification based on nature of M-C bond, preparation, properties and uses of Organo-Lithium, preparation of Organo-Beryllium, Organo-Aluminium and Zeise salts. Structure of 1. Tri Methyl aluminium (Dimer) 2. Zeise Salt [PtCl<sub>2</sub>-C<sub>2</sub>H<sub>4</sub>] 3. Ferrocene</p>
3	<p><b>Chemistry of d-block elements:</b> Introduction, position of d-block elements in the periodic table, electronic configurations and definition, classifications of d-block elements in 3d, 4d, 5d and 6d series, physicochemical properties: atomic radii, ionic radii, metallic character and related properties, atomic volumes and densities, melting and boiling points, ionization energies, standard reduction potential values, variable oxidation states, colour of transition metal complex ions, magnetic properties of transition metal ions and their complexes, tendency of transition metals to form complex compounds, formation of interstitial compounds, catalytic activity, alloy formation.</p>



## **Learning Outcomes:-**

After the successful completion of the course, students will be able to

- Learn basic concepts of quantum chemistry and its applications.
- Understanding the concepts of isomerism, Valence bond theory in octahedral and tetrahedral complexes.
- Aware about general theories of d block element and noble gases.

## **Books Recommended:-**

1. 'Principles of Inorganic Chemistry', **Puri, Sharma and Kalia.**
2. 'Selected topics in Inorganic Chemistry', **Wahid U. Malik, G. D. Tuli, R. D. Madan.**
3. 'Introduction to Quantum Chemistry', **A K Chandra, McGraw-Hill.**
4. 'Advanced Inorganic Chemistry' (Volume-II), **Satya Prakash, G. D. Tuli, S. K. Basu & R D Madan.**
5. 'Advanced Inorganic chemistry', **Gurdeep Raj**, Goel Publishing House.
6. 'Shriver and Atkins' Inorganic Chemistry: **Atkins, Overton, Rourke, Weller, Armstrong**, Oxford University Press.
7. 'Advanced Inorganic Chemistry', **Cotton Wilkinson**, *W S E Wiley.*

## **E-Resources:-**

1. <http://chemed.chem.purdue.edu/genchem/topicreview/bp/ch12/complex.php>
2. <http://www.britannica.com/science/coordination-compound>
3. [http://www.chemistry.wustl.edu/~edudev/LabTutorials/naming\\_coord\\_comp.html](http://www.chemistry.wustl.edu/~edudev/LabTutorials/naming_coord_comp.html)
4. [http://chemwiki.ucdavis.edu/Core/Inorganic\\_Chemistry/Coordination\\_Chemistry/Coordination\\_Compounds](http://chemwiki.ucdavis.edu/Core/Inorganic_Chemistry/Coordination_Chemistry/Coordination_Compounds)
5. <http://www.britannica.com/science/organometallic-compound>
6. <http://www.chemistryexplained.com/Ny-Pi/Organometallic-Compounds.html>
7. <http://pac.iupac.org/publications/pac/pdf/1999/pdf/7108x1557.pdf>
8. [http://www.tcm.phy.cam.ac.uk/~bds10/aqp/handout\\_foundations.pdf](http://www.tcm.phy.cam.ac.uk/~bds10/aqp/handout_foundations.pdf)
9. [http://www.chemicalelements.com/groups/noble\\_gases.html](http://www.chemicalelements.com/groups/noble_gases.html)
10. [https://www.sciencedaily.com/terms/noble\\_gas.htm](https://www.sciencedaily.com/terms/noble_gas.htm)
11. [http://chemwiki.ucdavis.edu/Core/Inorganic\\_Chemistry/Descriptive\\_Chemistry/Elements\\_Organized\\_by\\_Block/3\\_d-Block\\_Elements](http://chemwiki.ucdavis.edu/Core/Inorganic_Chemistry/Descriptive_Chemistry/Elements_Organized_by_Block/3_d-Block_Elements)
12. <http://www.citycollegiate.com/dblock1.htm>



**FACULTY OF SCIENCES**  
**DEPARTMENT OF CHEMISTRY**

**COURSE: B.Sc.**

**SEMESTER: IV**

**SUBJECT NAME: Physical Chemistry-II**

**SUBJECT CODE: 4SC04PCH1**

**Teaching & Evaluation Scheme:-**

Teaching hours/week				Credit	Evaluation Scheme/semester							
Th	Tu	Pr	Total		Theory				Practical		Total Marks	
					Sessional Exam		University Exam		Internal			University
					Marks	Hrs	Marks	Hrs	Pr	TW		
3	0	0	3	3	30	1.5	70	3	--	--	--	100

**Objectives:-**

- To understand concept and theories of basic physical chemistry.
- To understand and use physical properties in determining chemical constituent.
- To get idea about photochemistry and thermo chemistry.
- To generate awareness about various types polymers.

**Prerequisites:-**

- Before learning Physical chemistry, student should aware about basic principles and theories of physical chemistry, laws of thermodynamics, photochemistry, chemical reactions and other UG level chemistry.

**Course outline:-**

Sr. No.	Course Contents
1	<b>Physical Properties and Chemical Constitution</b> Introduction, Parachor and chemical constitution, optical activity and chemical constitution, dipole moment, determination of dipole moment, bond moment, dipole moment and molecular structure, magnetic properties, measurement of magnetic properties, magnetic properties and molecular structure, molecular spectra, types of molecular spectra (introduction only).



<b>2</b>	<b>Photochemistry</b> Introduction, Difference between photochemical and thermal reaction, Light absorption, determination of absorbed intensity, laws of photochemistry, primary and secondary reactions, quantum yield, causes of high quantum yield with example, causes of low quantum yield with example, calculation of quantum yield, photosensitized reactions, photo-physical processes. <b>Thermochemistry</b> Introduction, enthalpy of reaction, exothermic and endothermic reactions, calculation of $\Delta H$ and $\Delta E$ , heat of reaction, variation of heat of reaction with temperature, different types of heat of reactions, energy change during transition or phase change, Hess's law of constant heat summation.
<b>3</b>	<b>Polymers</b> Introduction, difference between simple molecule and polymer, classification of polymer depending on structure, chemical properties and physical properties, co-polymer, addition polymerization, free radical polymerization, ionic polymerization, Zigler-Natta polymerization, polycondensation polymerization, stereochemistry of polymers, degree of polymerization and molecular weight of polymers, synthesis of Bakelite, Teflon, melamine, phenol formaldehyde resin, poly ethylene and polyvinyl chloride.

### Learning Outcomes:-

After the successful completion of the course, students will be able to

- Determine the chemical constitution from physical properties.
- Concept of photochemistry and thermal chemistry.
- Understand the applications and use of polymers in day today life.
- They can be able to apply basics into their experiment as well as their routine life.

### Books Recommended:-

1. 'A Textbook of physical chemistry', **K. K. Sharma, L. K. Sharma.**
2. 'Physical Chemistry', **Dr. D. R. Pandit, A.R. Rao and Padke.**
3. 'A Textbook of physical chemistry', **Samuel Glasstone.**
4. 'A Textbook of physical chemistry', **B. K. Sharma.**
5. 'Principles of Physical Chemistry', **P. W. Marron and C. F. Prutton.**
6. 'Chemical Kinetics', **K. J. Laidler, McGraw Hill.**
7. 'Chemistry for Engineers', **Dr. B. K. Ambasta, Laxmi Publications (P) LTD., New Delhi.**
8. 'Elements of Physical Chemistry', **P. W. Atkins, Oxford.**
9. 'Elements of Physical Chemistry', **Peter Atkins, Julio de Paula, 4<sup>th</sup> Edition, Oxford University Press.**
10. 'A Textbook of Physical Chemistry', **A. S. Negi & S. C. Anand, New Age International Publishers.**





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11. 'Comprehensive Physical Chemistry for B.Sc', **B. K. Vermani, Vivek Pathania and S. Kiran Vermani**, *Laxmi Publications (P) LTD.*, New Delhi.
12. 'A Textbook of Physical Chemistry', **K. L. Kapoor**, *Macmillan*.
13. 'Essentials of Physical Chemistry', **B. S. Bahl, Arun Bahl and G. D.Tuli**, *S. Chand & Company*.

### **E-Resources:-**

1. <https://en.wikipedia.org/wiki/Parachor>
2. [http://chemwiki.ucdavis.edu/Core/Physical\\_Chemistry/Physical\\_Properties\\_of\\_Matter/Atomic\\_and\\_Molecular\\_Properties/Intermolecular\\_Forces/Specific\\_Interactions/Dipole\\_moments](http://chemwiki.ucdavis.edu/Core/Physical_Chemistry/Physical_Properties_of_Matter/Atomic_and_Molecular_Properties/Intermolecular_Forces/Specific_Interactions/Dipole_moments)
3. <https://www.youtube.com/playlist?list=PLA1A08D1AF30B1FA3>
4. <http://alevelnotes.com/Thermochemistry/105?tree=>
5. [http://www.chemistry.uoguelph.ca/educmat/chm19105/thermochemistry\\_notes.htm](http://www.chemistry.uoguelph.ca/educmat/chm19105/thermochemistry_notes.htm)



**FACULTY OF SCIENCES**  
**DEPARTMENT OF CHEMISTRY**

**COURSE: B.Sc.**

**SEMESTER: IV**

**SUBJECT NAME: Industrial Chemistry-I**

**SUBJECT CODE: 4SC04IDC1**

**Teaching & Evaluation Scheme:-**

Teaching hours/week				Credit	Evaluation Scheme/semester								
Th	Tu	Pr	Total		Theory				Practical				Total Marks
					Sessional Exam		University Exam		Internal		University		
					Marks	Hrs	Marks	Hrs	Pr	TW			
3	0	0	3	3	30	1.5	70	3	--	--	--	100	

**Objectives:-**

- To learn about industrial chemistry and industrial synthesis materials.
- To understand fundamentals of pesticides, fertilizers and their applications.
- Aware about industrial chemistry, glass, ceramic, pesticides etc.

**Prerequisites:-**

- Before learning chemistry, student should aware about basic principles and theories of industrial and basic chemistry and other UG level chemistry.

**Course outline:-**

Sr. No.	Course Contents
1	<b>Glass and Ceramic:</b> <b>Glass:</b> Introduction, physical and chemical properties of glass, characteristics of glass, raw material, chemical reaction, methods of manufacturing, formation of batch material, furnaces, application and uses of glass. <b>Ceramic:</b> Introduction, types of ceramic, general properties of ceramic, manufacturing process of ceramic, applications of ceramic.



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<b>2</b>	<b>Insecticides:</b> Introduction, classification of insecticides, inorganic and organic insecticides, synthesis and uses of dinitrophenols, DDT, Methoxychlor, Benzene hexachloride, Gammexane, Aldrin, Dieldrin, Malathion, Parathion, Fumigents, Miticides, biodegradation of pesticides, application of pesticides.
<b>3</b>	<b>Fertilizers:</b> Plant nutrients, micro nutrients, need for fertilizer, essential requirements, fertility of the soil, pH value of the soil, and source of fertilizer, nitrogenous fertilizers urea, and ammonia. Bio fertilizer, application of fertilizer.

### **Learning Outcomes:-**

After the successful completion of the course, students will be able to

- Understand pesticides and its applications.
- Understand the synthesis and manufacturing process of glass and ceramic.
- They can be able to apply basics into their experiment as well as their routine life.

### **Books for References:**

1. 'Pollution control in chemical and allied industries', by **S. P. Mahajan**.
2. 'Pollution control in industries. A series of books', by **H. R. Jones**.
3. 'System's approach to air pollution control', **R. J. Bibbero and I. G. Young**.
4. 'Air pollution Volume, **A. C. Stern**, *Academic press*.
5. 'Air pollution technologies', **Painter D. E.**, *Reston publishing company*.
6. 'Effluent treatment in process industries and waste disposal', **Instrumentation of chemical engineering**.
7. 'Industrial instrumentation', **D. P. Eckman**, *John – Wiley's and sons*.
8. 'Applied instrumentation in process industries', **W. G. Andrews**, *Gulf publication*.
9. 'Instrumentation and control for the process industries', **S. Borer**, *Elsevire applied science publisher*.
10. 'Chemical engineers handbook', **J. H. Perry and D. Green**, *McGraw Hill publishing company*, New York.
11. 'Industrial chemistry', **B. K. Sharma**, *S. Chand & Company*.

### **E-Resources:-**

1. <http://pubs.acs.org/loi/jpchax>
2. <http://www.csulb.edu/~lhenriqu/chem.htm>
3. <http://libguides.stanford.edu/content.php?pid=114712&sid=991132>
4. [http://simple.wikipedia.org/wiki/Physical\\_chemistry](http://simple.wikipedia.org/wiki/Physical_chemistry)
5. [http://chemistry.olivet.edu/chemistry\\_library.htm](http://chemistry.olivet.edu/chemistry_library.htm)



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6. <http://as.wiley.com/WileyCDA/WileyTitle/productCd-EHEP000800.html>
7. <http://www.chemsoc.dk/KFlinks.htm>



**FACULTY OF SCIENCES**  
**DEPARTMENT OF CHEMISTRY**

**COURSE: B.Sc.**

**SEMESTER: IV**

**SUBJECT NAME: Chemistry Practical-IV**

**SUBJECT CODE: 4SC04PRC1**

**Teaching & Evaluation Scheme:-**

Teaching hours/week				Credit	Evaluation Scheme/semester							
Th	Tu	Pr	Total		Theory				Practical		Total Marks	
					Sessional Exam		University Exam		Internal			University
					Marks	Hrs	Marks	Hrs	Pr	TW		
0	0	6	6	3	--	--	--	--	10	10	30	50

**Objectives:-**

- To understand inorganic compounds and identification
- To learn practical principles related to inorganic chemistry and chromatography
- To learn and understand titrations and estimations
- To create interest in students in learning basic chemistry.

**Prerequisites:-**

- Before studying practical of chemistry, all students have basic knowledge of inorganic and organic compounds, properties, molecular structure and knowledge related to UG level chemistry.

**Course outline:-**

Sr. No.	Course Contents
1	<b>Inorganic Qualitative Analysis:</b> Qualitative Analysis of an inorganic mixture containing four radicals, excluding $\text{PO}_4^{-3}$ , $\text{CrO}_4^{-2}$ , $\text{Cr}_2\text{O}_7^{-2}$ , $\text{AsO}_3^{-3}$ , $\text{AsO}_4^{-3}$ , $\text{BO}_3^{-3}$ and $\text{S}^{-2}$
2	<b>Physicochemical Exercise</b> 1. To determine the specific reaction rate of the hydrolysis of methyl acetate/ethyl acetate catalyzed by $\text{H}^+$ ion at room temperature. 2. To study the rate of reaction between $\text{K}_2\text{S}_2\text{O}_8$ and KI.



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	<p>3. To study the rate of reaction between <math>\text{KBrO}_3</math> and <math>\text{KI}</math>.</p> <p>4. To determine the relative strength of <math>\text{HCl}</math> and <math>\text{H}_2\text{SO}_4</math>.</p> <p>5. To determine the temperature coefficient and Energy of activation for the hydrolysis of ester at two different temperatures.</p> <p>6. To determine the temperature coefficient and Energy of activation for the reaction between <math>\text{K}_2\text{S}_2\text{O}_8</math> and <math>\text{KI}</math> at two different temperatures.</p>
<b>3</b>	<b>Chromatography</b> <p>a. Separation of a mixture of two amino acids by ascending and horizontal paper chromatography.</p> <p>b. Separation of a mixture of two sugars by ascending paper chromatography.</p>

### Learning outcomes:-

After the successful completion of the course, students will be able to:

- Understand basic principal of chemistry practical.
- Understand Qualitative Analysis of an inorganic mixture.
- Understand estimation and titrations.
- Separation of a mixture by chromatography.

### Books for References:

1. 'Textbook of practical chemistry', **Vogel**.
2. 'Practical chemistry', **Pandey**.
3. 'Practical in inorganic chemistry & analytical chemistry', **H. G. Raval, Nirav & Rupal Prakashan**.

### E-Resources:-

1. <http://pubs.acs.org/journal/inocaj>
2. [http://www.chemlin.de/chemistry/inorganic\\_chemistry.htm](http://www.chemlin.de/chemistry/inorganic_chemistry.htm)
3. <http://www.anorg.chem.uu.nl/home/index.html>
4. <http://www.springer.com/chemistry/inorganic+chemistry/journal/11502>
5. <http://libguides.stanford.edu/content.php?pid=149720&sid=1271547>
6. <http://www.science.uwaterloo.ca/~cchieh/cact/applychem/inorganic.html>