



C. U. SHAH UNIVERSITY



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

B.Sc.

SEM-III

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



FACULTY OF SCIENCES
DEPARTMENT OF CHEMISTRY

COURSE: B.Sc.

SEMESTER: III

SUBJECT NAME: Organic Chemistry-I

SUBJECT CODE: 4SC03OCH1

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 basics theories and principles related to organic chemistry/heterocyclic chemistry.
- To learn and understand various nucleophilic and electrophilic reactions in organic chemistry.
- To create interest in students in learning organic chemistry.

Prerequisites:-

- Before studying organic chemistry, all students have basic knowledge of organic compounds, molecular structure, molecular orbital theories and knowledge related to basics of chemistry.

Course outline:-

Sr. No.	Course Contents
1	a) Fundamental Aspects in Organic Chemistry Hybridization, sigma and pi-bonds, hydrogen bond, inductive effect, resonance effect, hyper-conjugation, steric effect, acids and bases, structure and stability of carbocation, carbanions and free radicals, aromaticity: Benzenoids and Huckel's rule. b) Electrophilic aromatic substitution Introduction, effect of substituent group, classification of substituent group, electrophilic substitution reactions like Nitration, Sulphonation, Friedal-crafts alkylation and acylation.



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2	<p>a) Aldehydes and Ketones IUPAC nomenclature of aldehydes and ketones, preparation of aldehydes and ketones, physical properties of aldehydes and ketones, chemical reactions of aldehydes and ketones (reaction with HCN, ROH, NH₂-G derivatives), Cannizzaro reaction, Wittig reaction, Aldol condensation.</p> <p>b) Carboxylic acid and derivatives IUPAC nomenclature of mono and dicarboxylic acids, synthesis, physical and chemical properties of mono carboxylic acids, Hell Volhard Zelinsky reaction, Formation of acid derivatives-acid chloride, anhydrides, esters and amides.</p>
3	<p>Five-membered heterocyclic compounds Introduction, tautomerism, physical properties of pyrrole, furan and thiophene, synthesis of pyrrole (Knorr synthesis, Paal-knorr synthesis, Hantzsch synthesis), chemical reactions of pyrrole, synthesis of furan (Paal-Knorr synthesis, Fiest Benary reaction, from other heterocyclic system), chemical reactions of furan, synthesis of thiophene (Paal-knorr synthesis, Simmon-smith reaction, from unsaturated compounds), chemical reactions of thiophene.</p>

Learning Outcomes:-

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

- Basic aspects in organic chemistry.
- Studies of five membered heterocyclic compounds.
- Nucleophilic and electrophilic reaction mechanisms.

Books Recommended:-

1. 'A Text Book of Organic Chemistry', **R. K. Bansal**, *New Age International (P) Ltd.*
2. 'Organic Reaction Mechanism', **V. K. Ahluwalia**, *R.K. Parasar.*
3. 'Organic Chemistry', **Morrission and Boyd**, *prentice hall of India pvt ltd.*
4. 'Organic Chemistry', **I. L. Finar**, *Pearson Education.*
5. 'Advanced Organic Chemistry', **Jerry March.**
6. 'Reaction Mechanism and Reagents in Organic Chemistry', **Gurdeep R. Chatwal.**
7. 'Organic Chemistry', **V. K. Ahluwalia, Madhuri Goyal**, *Narosa Publishing House.*
8. 'Organic Synthesis', **M. B. Smith**, *Mcgraw-Hill, Inc.*
9. 'Comprehensive Organic Synthesis', **B.M. Frost & I Fleming**, *Pergamon.*
10. 'Organic Chemistry – Structure and Reactivity', **Seyhan Ege**, *A.I.T.B.S. Publishers and Distributors.*
11. 'Organic Synthesis – Strategy and Control', **Paul Wyatt & Stuart Warren**, *John Wiley & Sons.*
12. 'Principles of Organic Synthesis', **R. O. C. Norman, J. M. Coxon**, *CRC Press.*
13. 'Organic Chemistry', **J. Clayden, N. Greeves, S. Warren, P. Wothers**, *Oxford University Press.*



14. 'Organic Chemistry', J. McMurry, *Asian Books Pvt. Ltd.*

E-Resources:-

1. <http://www.organic-chemistry.org/>
2. <https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/aldket1.htm>
3. <https://www2.chemistry.msu.edu/faculty/reusch/virttxtjml/crbacid1.htm>
4. <http://www.britannica.com/science/heterocyclic-compound>
5. http://www.organicdivision.org/?nd=p_organic_web_links
6. <http://www.masterorganicchemistry.com/resource-guide/>
7. <http://orgchem.iisc.ernet.in/chemlink.html>
8. 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>
13. <http://www.stolaf.edu/depts/chemistry/courses/toolkits/247/>
14. <http://iverson.cm.utexas.edu/courses/310M/MainPagesSp06/GoldenRules.html>
15. [http://www.abdn.ac.uk/curly-arrows/index.html%20\(click%20the%20Tutorials%20button\)](http://www.abdn.ac.uk/curly-arrows/index.html%20(click%20the%20Tutorials%20button))
16. www.wikipedia.org/organic



FACULTY OF SCIENCES

DEPARTMENT OF CHEMISTRY

COURSE: B.Sc.

SEMESTER: III

SUBJECT NAME: Inorganic Chemistry-I

SUBJECT CODE: 4SC03ICH1

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 chemical and physical properties of elements in the periodic table.
- To learn structures and bonding in boranes.
- To study the complexity of various compounds in aqueous solutions according to CFT.
- To study general, physical and magnetic properties of Lanthanides and Actinides.

Prerequisites:-

- Before studying inorganic chemistry, all students have basic knowledge of inorganic compounds, molecular structure, Molecular orbital theories and knowledge related to 10+2 level chemistry.

Course outline:-

Sr. No.	Course Contents
1	<p>(A) Chemical periodicity Periodic table, group trends and periodic trends in physical properties, classification of elements on the basis of electronic configuration, modern IUPAC periodic table, and general characteristic of s, p, d and f block elements, position of hydrogen and noble gases in the periodic table.</p> <p>(B) Electron-deficient compounds: Boranes Preparation and properties of boranes, diborane, uses of diborane, structure and bonding in diborane.</p>



2	Stability of Complexes in Aqueous Solution: Definition of stability, stepwise formation of complexes, stepwise formation and overall formation constants, kinetic vs thermodynamic stability, labile and inert octahedral complexes according to CFT, factors affecting on the stability of complexes, experimental determination of stability constant and composition of a complex (spectrophotometric method, Job's method of continuous variation, Potentiometric Bjerrum method).
3	Lanthanides And Actinides (A) Lanthanides: Definition, General properties- electronic configuration, oxidation state and oxidation potential, chemistry of +2, +3 and +4 state, atomic and ionic radii, lanthanide contraction, cause of lanthanide contraction, consequences of lanthanide contraction, color and absorption spectra of Ln^{+3} ion, magnetic properties and complex formation, extraction of lanthanides from monazite mineral, separation of individual rare earth elements by modern methods- ion exchange method, solvent extraction method, uses of lanthanide compounds. (B) Actinides: Definition, general properties and their comparison with lanthanides like - electronic configuration, oxidation state and oxidation potential, chemistry of +2, +3, +4, +5, +6 and +7 oxidation state, Atomic and ionic radii, actinide contraction, color and absorption spectra, magnetic properties and complex formation, separation of actinide elements by- ion exchange method and solvent extraction method.

Learning Outcomes:-

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

- Learn basic concepts and theories related to periodic table.
- Understanding of magnetic properties, chemical applications and other theoretical aspects of lanthanides and actinides.
- They can get idea about complexity of the compound in the aqueous solution.

Books Recommended:-

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



E-Resources:-

1. <http://www.chem.msu.ru/eng/misc/mendeleev/hyper/>
2. <http://www.compoundchem.com/2014/02/12/periodicity-trends-in-the-periodic-table/>
3. https://en.wikipedia.org/wiki/Stability_constants_of_complexes
4. <http://www.springer.com/in/book/9780306452482>
5. <https://en.wikipedia.org/wiki/Lanthanide>
6. <http://chemistry.about.com/od/elementgroups/a/lanthanides.htm>
7. <http://www.infoplease.com/encyclopedia/science/lanthanide-series.html>
8. <https://en.wikipedia.org/wiki/Actinide>
9. http://chemwiki.ucdavis.edu/Core/Inorganic_Chemistry/Descriptive_Chemistry/Elements_Organized_by_Block/4_f-Block_Elements/The_Actinides



FACULTY OF SCIENCES

DEPARTMENT OF CHEMISTRY

COURSE: B.Sc.

SEMESTER: III

SUBJECT NAME: Physical Chemistry-I

SUBJECT CODE: 4SC03PCH1

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 physical chemistry.
- To get the idea about kinetic theory of gases and gas laws
- To study the properties of liquids like surface tension, viscosity etc.
- To generate interest about crystalline state of solids and liquid crystals.

Prerequisites:-

- Before learning Physical chemistry, student should aware about basic principles and theories of physical chemistry, thermodynamics, catalysis, gas laws, solid, liquid and gaseous state and other UG level chemistry.

Course outline:-

Sr. No.	Course Contents
1	Gaseous state General characteristics of gases, Gas laws, Grahms law of diffusion, the ideal gas equation, kinetic molecular theory of gases, derivation of kinetic gas equation, derivation of gas laws from kinetic theory, Distribution of molecular velocities, average velocity, root mean square velocity, most probable velocity, collision diameter, collision frequency, the mean free path, Deviation of real gas from ideal behavior, compressibility factor, Van der Waals equation of state for real gases, Liquification of gas-critical phenomenon, Andrews isotherm of CO ₂ .



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2.	Liquid State Intramolecular forces in liquids, vapor pressure, determination of vapor pressure, Surface tension, determination of surface tension by capillary rise method and drop formation method, Viscosity, measurement of viscosity, effect of temperature on surface tension and viscosity, refractive index, determination of refractive index, optical activity, measurement of optical activity.
3.	Solid State Types of solids, Symmetry of crystals, Bravais lattice, miller indices, X-ray crystallography, Bragg's equation and its derivation, measurement of diffraction angle by rotating crystal method and powder method, classification of crystals on the basis of bonds, liquid crystals, types of liquid crystals, application of liquid crystals.

Learning Outcomes:-

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

- Understand various laws of gaseous states and behavior of real gases.
- Concept of surface tension, refractive index and optical activity in liquids.
- Understand about various type of crystalline solids and applications of liquid crystals.
- 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. 'Elements of Physical Chemistry', **P. W. Atkins, Oxford.**
7. 'Elements of Physical Chemistry', **Peter Atkins, Julio de Paula, 4th Edition, Oxford University Press.**
8. 'A Textbook of Physical Chemistry', **A. S. Negi & S. C. Anand, New Age International Publishers.**
9. 'Comprehensive Physical Chemistry for B.Sc', **B. K. Vermani, Vivek Pathania and S. Kiran Vermani, Laxmi Publications (P) LTD., New Delhi.**
10. 'A Textbook of Physical Chemistry', **K. L. Kapoor, Macmillan.**
13. 'Essentials of Physical Chemistry', **B. S. Bahl, A. Bahl and G. D. Tuli, S. Chand & Company.**
14. 'Advanced Practical Physical Chemistry', **J. B. Yadav, Goel Publishing house, Krishna Prakashan Media (P) Ltd.**
15. 'Experimental Physical Chemistry', **V. D. Athawale & Parul Mathur, New Age International Publishers.**



E-Resources:-

1. https://en.wikibooks.org/wiki/Introductory_Chemistry_Online/Gaseous_State
2. <http://www.askiitians.com/revision-notes/chemistry/gaseous-state/>
3. <http://www.s-cool.co.uk/a-level/chemistry/states-of-matter/revise-it/the-gaseous-state-and-the-gas-laws>
4. <http://www.chemistryexplained.com/Kr-Ma/Liquids.html>
5. http://home.nas.net/~dbc/cic_hamilton/liqst.html
6. https://en.wikipedia.org/wiki/Solid-state_chemistry
7. <http://www.seas.upenn.edu/~chem101/sschem/solidstatechem.html>
8. <http://www.internetchemistry.com/chemistry/solid-state-chemistry.htm>



FACULTY OF SCIENCES
DEPARTMENT OF CHEMISTRY

COURSE: B.Sc.

SEMESTER: III

SUBJECT NAME: Analytical Chemistry-I

SUBJECT CODE: 4SC03ANC1

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 analytical chemistry.
- To get idea about instrumentation techniques.
- To understand applications of fluorescence techniques.
- To generate interest and curiosity about analytical chemistry.

Prerequisites:-

- Before learning analytical chemistry, student should aware about basic principles and theories of analytical chemistry, Basics of Optical Spectroscopy and other UG level chemistry.

Course outline:-

Sr. No.	Course Contents
1	Chromatography: Principle of adsorption and partition chromatography, column chromatography: adsorbents, classification of adsorbents, solvents, preparation of column, adsorption and applications. Thin Layer Chromatography: choice of adsorbent, choice of solvent, preparation of chromatogram, sample, R_f value and its applications. Paper chromatography, solvent used, R_f value, factors which affect R_f value.



2.	Potentiometry and pH metry: Introduction and interpretation of pH and potentiometry, Importance of indicator and reference electrode in measurement of EMF and pH E.M. F. method 1. Study of acid –base titration 2. redox titration 3. Argentometric titration including the mixture of Cl ⁻ , Br ⁻ , I ⁻ with graph and proper explanation pH metry: Definition, Interpretation of various methods of determining pH values like pH paper method, potentiometric method using only hydrogen electrode as indicator electrode and calomel electrode to determine pH value , Weak acid and strong base titration curve and determination of dissociation constant (K _a) of weak acid.
3.	Fluorescence spectroscopy: Principles of Fluorescence spectroscopy, instrumentation, Jablonski Diagram, types of fluorescence, factors influencing fluorescence intensity, quenching, types of quenching, advantages and limitations of Fluorimetry, applications.

Learning outcomes:-

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

- Understand basic analytical techniques and instrumental methods.
- Understand chromatography and its applications.
- To get idea about PH and potentiometry and its experimental techniques.

Books Recommended:-

1. 'Elementary Organic Spectroscopy: Principles and Chemical Applications', *S. Chand and company Ltd.*, New Delhi.
2. 'Analytical Chemistry: An Introduction', **D. A. Skoog, D. M. West and F. J. Holler**, 5th Edition, *Saunders college publishing*.
3. 'Analytical Chemistry: Theory and Practice', **U. N. Dash**, *Sultan Chand and sons Educational Publishers*, New Delhi.
4. 'Basic concept of Analytical Chemistry', **S. M. Khopkar**, *New Age International Publishers*, New Delhi.
5. 'Instrumental Methods of Chemical Analysis', *Chatwal Gurdeep R.*, Himalaya Pub. House
6. 'Instrumental methods of chemical analysis', *B. K. Sharma*, Krishna Prakashan, Merut.
7. 'Analytical chemistry', **R. Gopalan**, *S. Chand and Co.*, New Delhi.



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8. 'Introduction to Chromatography: Theory and Practice', V.K. Srivastava and K.K. Srivastava, *S. Chand and company*, New Delhi.
9. 'Modern Experimental Organic Chemistry', **R. M. Roberts, J. C. Gilbert, L. B. Rodewald, and A. S. Wingrove**, *Holt Saunders international editions*.
10. 'Chemical Analysis: An Instrumental Approach for B.Sc. Hons. and M.Sc. Classes', **A. K. Srivastava and P. C. Jain**, *S. Chand and company Ltd.*, Ram Nagar, New Delhi.

E-Resources:-

1. <http://ukcatalogue.oup.com/product/9780199543373.do#.UhOsGtI3Bsk>
2. <http://web.mit.edu/speclab/www/links.html>
3. <http://library.duke.edu/research/subject/guides/chemistry/>
4. <http://www.chem.ox.ac.uk/cheminfo/internet.html>
5. <http://www.science.fau.edu/chemistry/links.htm>
6. <http://pubs.rsc.org/en/journals/journalissues/cp#!recentarticles&all>
7. <http://www.rsc.org/ConferencesandEvents/ISACS/PhysicalChemistryandNanoscience/index.asp>
8. <http://pubs.acs.org/loi/jpchax>
9. <http://www.csulb.edu/~lhenriqu/chem.htm>
10. <http://libguides.stanford.edu/content.php?pid=114712&sid=991132>
11. http://simple.wikipedia.org/wiki/Physical_chemistry
12. http://chemistry.olivet.edu/chemistry_library.htm
13. <http://as.wiley.com/WileyCDA/WileyTitle/productCd-EHEP000800.html>
14. <http://www.chemsoc.dk/KFlinks.htm>
15. <http://www.library.auckland.ac.nz/subject-guides/chem/chemmeta.htm>



FACULTY OF SCIENCES
DEPARTMENT OF CHEMISTRY

COURSE: B.Sc.

SEMESTER: III

SUBJECT NAME: Chemistry Practical-III

SUBJECT CODE: 4SC03PRC1

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	100

Objectives:-

- To understand organic compounds and identification of their functional group.
- To learn practical principles related to organic, volumetric, gravimetric identification preparation estimation and titration.
- 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	Organic qualitative analysis: Identification of binary mixture of organic compounds containing more than one functional groups.
2	Gravimetric Analysis: Gravimetric estimation of nickel, aluminium, zinc and iron. Volumetric analysis: Acid base, Redox, Iodometry-Iodimetry titrations.



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Learning outcomes:-

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

- Understand basic principle of chemistry practical.
- Understand estimation and titrations.

Books for References:

1. "Textbook of practical chemistry" by **Vogel**.
2. "Practical chemistry" by **Pandey**.
3. "Practical in organic chemistry", **Dr. Ramesh K. Goyal**, *B. S. Shah Prakashan*

E-Resources:-

1. <http://ukcatalogue.oup.com/product/9780199543373.do#.UhOsGtl3Bsk>
2. <http://web.mit.edu/speclab/www/links.html>
3. <http://library.duke.edu/research/subject/guides/chemistry/>
4. <http://www.chem.ox.ac.uk/cheminfo/internet.html>