

**Objectives:**

- To study chemical bonding and covalent compounds.
- To make students capable of understanding the basics of catalysis.
- To study the introduction, properties and preparation of alcohol, phenol and ether.
- To study the first, second and third order reaction and its applications.

**Credits Earned:** 5 Credits

**Course Outcomes:** After completion of this course, student will be able to

- Understand the concepts of various chemical bonding and covalent compounds.
- Be aware of the basics of reaction mechanism, structure and stability of reacting constituents.
- Obtain the information regarding first, second and third order reaction and its applications.
- Will able to get more insights in the field of catalysis and reaction chemistry, which is very important by means of chemical industry process.

**Pre-requisite of course:** Before studying fundamental chemistry part I, all students must have apparent knowledge of organic chemistry at 12<sup>th</sup> standard level. It draws an attention towards the elementary understanding for the formation of bonding (e.g. oxidation state and octet rule). This part will also require unavoidable shallow knowledge of chemistry studied during the 12<sup>th</sup> level. It includes points which will be useful to understand the topics covered such as preparation and properties of organic compounds and study regarding catalysis and order of reaction, which is of important during the understanding/teaching process of this course.

**Teaching and Examination Scheme**

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	Mid Sem (M)	Internal (I)	Viva (V)	Term work (TW)	
4	-	2	5	50	30	20	25	25	150

**Contents:**

<b>Unit</b>	<b>Topics</b>	<b>Contact Hours</b>
1	<b>Chemical bonding and covalent compounds</b> Introduction, Valence Bond Theory and its limitations, sigma and pi bonds, Hybridization, Stereochemistry of inorganic molecules, Sidgwick Powell Rule, VSEPR Theory, Molecular Orbital Theory, Difference between VBT and MOT, Bond order, Energy level diagram for molecular orbitals	12
2	<b>Catalysis:</b> Introduction, Types of Catalyst, Characteristic of catalysis, Functions, Homogeneous and Heterogeneous catalysis, Acid base Catalyst, Enzyme Catalyst, Applications	10
3	<b>Alcohol, Phenol, Ether:</b> Introduction, IUPAC Nomenclature of alcohols, Phenols and Ethers, Physical properties of alcohol, phenol and ethers, Chemical properties of alcohols, Industrial production of phenol by dow process and cumene process, Chemical properties of phenol or electrophilic substitution reactions of phenol, Reimer-Tiemann reaction with mechanism, Kolbe-Schmitt reaction with mechanism with mechanism, Fries reaction with mechanism , Preparation of Ethers, Chemical reaction of ethers.	15
4	<b>Chemical Kinetics</b> Introduction, Order and molecularity of a reaction, Zero order reaction, First order reaction & it's characteristics, Second order reaction & it's characteristics, Third order reaction & it's characteristics, Pseudo unimolecular reaction, Method for determining the order of reaction. Graphical method, Ostwald's isolation method, Method of half-life period, Integration method. Theories of reaction rates. Collision theory, The transition statetheory, Influence of temperature on reaction rates, Energy of activation	13
<b>Total Hours</b>		<b>60</b>

**References:**

1. K L Kapoor, A Textbook of Physical Chemistry, Volume 1, 3<sup>rd</sup> Edition, Macmillan India Ltd.
2. K.L. Kapoor, A Textbook of Physical Chemistry, Volume 2, 3<sup>rd</sup> Edition, Macmillan India Ltd.
3. R. P. Rastogi, R. R. Misra, An Introduction to Chemical Thermodynamics, 6<sup>th</sup> edn., Vikas Pub. Pvt. Ltd. (2003).
4. G. W. Castellan, Physical Chemistry, 3<sup>rd</sup> edn., Narosa Publishing House, New Delhi, (2004).
5. Arun Bahl & J.D Tuli, Physical Chemistry, Multicolour edition, S. Chand Publishing.
6. P. S. Kalsi, 'Organic Reactions and their Mechanisms', New Age International Publishers.
7. R. T. Morrison and R. N. Boyd, 'Organic Chemistry', 6<sup>th</sup> Edition - Prentice Hall of India.
8. E. J. D. Lee, Concise Inorganic Chemistry, 5<sup>th</sup> edn., Blackwell Science, London.
9. Organic Reaction Mechanism by S. N. Sanyal, 4<sup>th</sup> Edition. Paperback, India.

**Suggested Theory distribution:**

The suggested theory distribution as per Bloom's taxonomy is as per follows. This distribution serves as guidelines for teachers and students to achieve effective teaching-learning process.

Distribution of Theory for course delivery and evaluation					
Remember	Understand	Apply	Analyze	Evaluate	Create
20%	20%	30%	15%	10%	5%

**Volumetric Analysis and Calibration:**

1. Determination of acetic acid in commercial vinegar using 0.1 M NaOH.
2. To determine the normality, molarity and gms/litre of NaOH and HCl using 0.05M Na<sub>2</sub>CO<sub>3</sub> solution.

**Chemistry**

3. To determine the molarity, g/litre and normality of each component in a mixture of  $\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$  and  $\text{H}_2\text{SO}_4$  using 0.02 M  $\text{KMnO}_4$  and 0.1 M NaOH solution
4. To determine the molarity, g/litre and normality of each component in a mixture of  $\text{H}_2\text{C}_2\text{O}_4 \cdot 2\text{H}_2\text{O}$  and  $\text{K}_2\text{C}_2\text{O}_4 \cdot \text{H}_2\text{O}$  using 0.1 M NaOH and 0.02 M  $\text{KMnO}_4$  solution.
5. Determination of alkali in antacid by using 0.1 M HCl solution.
6. To calibrate and determine the melting point of organic compound.
7. To calibrate and determine the boiling point of organic compound.

**Reference Books:**

1. Concise Inorganic Chemistry by J. D. Lee, ELBS.
2. Basic Inorganic Chemistry by - FA. Cotton and G. Wilkinson
3. Inorganic Chemistry by SuretkerThate
4. Principles of Inorganic Chemistry- B.R. Puri, L.R. Sharma & K.C Kalia; Vallabh Publications, Delhi
5. Modern Aspects of Inorganic Chemistry - H.J. Emeleus and A.G. Sharpe; Routledge & Kegan Paul Ltd., 39 Store street, London WC1E7DD
6. Organic Chemistry by Morrison and Boyd
7. Organic Chemistry (Volume I, II & III) S.M. Mukherji, S.P. Singh and R.P. Kapoor
8. Organic Chemistry by T.W. Graham Solomons and Craig B. Fryhle
9. Organic Chemistry by I.L. Finar

**Instructional Method:**

1. The course delivery method will depend upon the requirement of content and need of students. The teacher in addition to conventional teaching method by black board, may also use any of tools such as demonstration, role play, Quiz, brainstorming, MOOCs etc.
2. The internal evaluation will be done on the basis of continuous evaluation of students in the laboratory and class-room.
3. Practical examination will be conducted at the end of semester for evaluation of performance of students in laboratory.
4. Students will use supplementary resources such as online videos, NPTEL videos, e-courses, Virtual Laboratory

**Chemistry**

5. Use of hazardous/toxic chemicals should be avoided as far as possible in laboratory.
6. All students in the laboratory must wear safety goggles and lab coats during lab session.

**Supplementary Resources:**

1. <http://nptel.ac.in/course.php?disciplineId=104>
2. <http://ocw.mit.edu/courses/chemistry/>
3. <http://vlab.amrita.edu/index.php?sub=2>
4. [http://www.vlab.co.in/ba\\_labs\\_all.php?id=9](http://www.vlab.co.in/ba_labs_all.php?id=9)
5. <https://www.youtube.com/watch?v=gyxgVsXMYq0&list=PL7jfMV2bTYmqnYac3pdt9uaDNCXvffayK>