

**Subject Code: 02CY0202**
**Subject Name: Fundamental Chemistry-III**
**B.Sc. Sem - III**
**Objectives:**

- To study physical aspects of coordination chemistry of d-block elements.
- To make students capable of understanding qualitative and quantitative analysis.
- To study the basic information regarding fundamentals of organic reaction.
- To study the concepts of carboxylic acids and its derivatives

**Credits Earned: 6 Credit**
**Course Outcomes:** After completion of this course, student will be able to

- Understand the concepts of co-ordination chemistry of d-block elements.
- Be aware of the basics of reaction mechanism and structure & stability of reacting constituents.
- Obtain the information regarding qualitative and quantitative analysis.
- Understand the basic of organic chemistry.

**Pre-requisite of course:** Before studying fundamental chemistry part II, all students must have superficial knowledge of periodic table studied in 12<sup>th</sup> standard level. This unit also require basic knowledge organic chemistry and analytical chemistry.

**Teaching and Examination Scheme**

Teaching Scheme (Hours)			Credits	Theory Marks			Tutorial/ Practical Marks		Total Marks
Theory	Tutorial	Practical		ESE (E)	IA	CSE	Viva (V)	Term Work (TW)	
4	-	3	6	50	30	20	25	25	150

**Contents**

Unit	Topics	Contact Hours
1	<b>Coordination Chemistry of d-block Elements:</b> Introduction, Werner's theory, IUPAC Nomenclature, Properties of complex compounds, Stability of complex compounds, Types of ligand, Isomerism, Structural Isomerism, Ionization Isomerism, Hydrate or Solvate isomerism, Ligand Isomerism, Coordination isomerism, Coordination position isomerism, Polymerisation isomerism, Linkage isomerism, Valence isomerism, Stereo isomerism, Geometrical isomerism (4 coordinated and 6 coordinated complex compounds) and optical isomerism (6 coordinated complex compound), Application of complex compounds.	15
2	<b>Basic of Qualitative and Quantitative Analysis:</b> Introduction, Group separation by wet test, Common ion effect, Use of HCl and H <sub>2</sub> S in qualitative analysis, Use of NH <sub>4</sub> Cl and NH <sub>4</sub> OH in qualitative analysis, Flame test, Borex bead test, Charcoal cavity test, Cobalt nitrate test, Titration, Back titration, End point, equivalence point, Indicator, Types of indicator, Primary and secondary standards, Difference between end point and equivalence point, Gravimetric analysis.	15
3	<b>Fundamentals of Organic reactions</b> Aromaticity: Benzenoids and Huckel's rule, Types of reactions, SN1 and SN2 reactions with mechanisms, Neighbouring group participation in displacement reactions, Addition reactions (electrophilic, nucleophilic, free radicals), E1 and E2 reactions, substitution reactions like Nitration, Sulphonation, Friedal-crafts alkylation and acylation.	15
4	<b>Carboxylic Acids and its derivatives</b> Monocarboxylic acids, Nomenclature, Acidity of carboxylic acids, Effect of substituents on acidity, Methods of preparation, Chemical properties and physical properties of : 1) Carboxylic acids 2) Acid halides 3) Anhydrides 4) Esters and 5) Amides	15
<b>Total Hours</b>		<b>60</b>

**References:**

1. A Textbook of Physical Chemistry; K. L. Kapoor
2. An Introduction to Chemical Thermodynamics; R. P. Rastogi, R. R. Misra, 6<sup>th</sup> Edition, Vikas Pub. Pvt. Ltd.
3. Physical Chemistry; G. W. Castellan, 3<sup>rd</sup> Edition, Narosa Publishing House, New Delhi.
4. Physical Chemistry; Arun Bahl & J. D. Tuli, S. Chand Publishing.
5. Organic Reactions and their Mechanisms; P. S. Kalsi, New Age International Publishers.
6. Organic Chemistry; R. T. Morrison and R. N. Boyd, 6<sup>th</sup> Edition, Prentice Hall of India.
8. Concise Inorganic Chemistry; J. D. Lee, 5<sup>th</sup> Edition, Blackwell Science, London.
9. Basic Inorganic Chemistry; F. A. Cotton, G. Wilkinson

10. Principles of Inorganic Chemistry; B. R. Puri, L. R. Sharma, K. C. Kalia, Vallabh Publications, Delhi
11. Organic Chemistry; Morrison and Boyd
12. Organic Chemistry (Volume I, II & III); S. M. Mukherji, S. P. Singh, R. P. Kapoor.
13. Principles of physical chemistry; B.R. Puri, L.R. Sharma, M.S. Pathania.

**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%	30%	25%	15%	10%	-

**Inorganic Volumetric Analysis:**

1. Estimation of the amount of  $\text{Cu}^{2+}$  in the given  $\text{CuCl}_2 \cdot 2\text{H}_2\text{O}$  solution using 0.01 M EDTA solution.
2. Estimation of the amount of  $\text{Ni}^{2+}$  in the given  $\text{NiSO}_4 \cdot 7\text{H}_2\text{O}$  solution using 0.01 M EDTA solution.
3. Estimation of the amount of  $\text{Zn}^{2+}$  in the given  $\text{ZnCl}_2$  solution using 0.01 M EDTA solution.

**Physico-chemical study:**

4. To determine the specific reaction rate of the hydrolysis of methyl acetate / Ethyl acetate catalyzed by  $\text{H}^+$  ion at room temperature.
5. To study the rate of reaction between  $\text{K}_2\text{S}_2\text{O}_8$  and KI.
6. To study adsorption of given organic acid on activated charcoal.
7. To study the partition co-efficient of benzoic acid between water and benzene / kerosene and hence study the molecular condition of benzoic acid in the solution.

**Reference Books**

1. An Advanced Course in Practical Chemistry, A. K. Nad, B. Mahapatra and A. Ghoshal, New Central Book Agency (P) Ltd.
2. Practicals in Physical Chemistry, P S Sindhu, Macmillan.

3. Experimental Physical Chemistry: A Laboratory Textbook, Arthur Halpern, George McBane, W. H. Freeman.

**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
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/user/TMPChem>
6. <https://www.youtube.com/playlist?list=PL166048DD75B05C0D>
7. <https://www.youtube.com/channel/UCqk-dmk3AOFtikaFDpsZorg>
8. <https://www.youtube.com/user/PradeepKshetrapal>