

**Subject Code: 02CY0353****Subject Name: Advanced Physical Chemistry****B.Sc. Sem - VI****Objectives:**

- To study details of the nuclear chemistry.
- To know more about activity and activity coefficient.
- To study the introduction of the crystallography.
- To study the Physical properties and chemical constitution.

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

- Understand the concepts of nuclear chemistry.
- Will know more about the activity and activity coefficient.
- Obtain the information regarding crystallography and its various types. Brief idea regarding unit cell will also get.
- Understand the physical properties and chemical constitution.

**Pre-requisite of course:** Basic understanding regarding nuclear chemistry, and crystallography is needed to learn this course fruitfully.**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)	
5	-	2	6	50	30	20	25	25	150

**Contents**

Unit	Topics	Contact Hours
1	<b>Nuclear chemistry:</b> Introduction, Radioactivity, Types of Radiations, Properties of Radiations, Detection and Measurement of Radioactivity, Types of Radioactive Decay, The Group Displacement Law, Rate of Radioactive Decay, Half-life, Radioactive Dating, Nuclear Reactions, Nuclear Fission Reactions, Nuclear Fusion Reactions,.	<b>10</b>
2	<b>Activity and activity coefficient:</b> Introduction, Concept of activity, activity coefficient, mean activity, ionic strength, methods of determining activity and activity coefficient, Equation of Debye-Huckel.	<b>10</b>
3	<b>Crystallography:</b> Introduction, Types of Solids, Isotropy and Anisotropy, The habit of a Crystal, Symmetry of Crystals, Miller Indices, How to Find Miller Indices, Crystal Structure, Parameters of the Unit Cells, Cubic Unit Cells, Three Types of Cubic Unit Cells, Calculation of Mass of the Unit Cell, What is Coordination Number of a Crystal Lattice, X-Ray Crystallography, Bragg's Equation, Measurement of Diffraction Angle, Rotating Crystal Method, Powder Method, Ionic Crystals, Sodium Chloride Crystal, Cesium Chloride Crystal,.,	<b>20</b>
4	<b>Physical properties and chemical constitution:</b> Surface Tension and Chemical Constitution, Use of Parachor in Elucidating Structure, Viscosity and Chemical Constitution, Dunstan Rule, Molar Viscosity, Rheochor, Dipole Moment, Determination of Dipole Moment, Dipole Moment and Molecular Structure, Dipole Moment and Ionic Character, Molar Refraction and Chemical Constitution, Optical Activity and Chemical Constitution.(vapour pressure)	<b>20</b>
<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%	-

**Colorimetry:**

1. To examine Lambert-Beer law in concentrated solutions.
2. To find the amount of  $\text{Ni}^{+2}$  in the given solution by colorimetry.
3. To find the amount of  $\text{Fe}^{+3}$  in the given solution by colorimetry.

**Polarimeter:**

4. To find the specific rotation of given substance by using three different concentration, i.e. 10%, 5% and 2.5%. Draw the graph of concentration vs rotation angle and find out the concentration of unknown solution.
5. To study the inversion rate of cane sugar in presence of 1 N HCl and determine the rate of reaction.

**Surface tension:**

6. Find the surface tension of the liquids A, B, and C by using Drop weight method. Find the value of Parachor of liquids and  $-\text{CH}_2$  group.

**Conductometry:**

7. To determine the concentration of  $\text{Ni}^{+2}$  with the help of 0.1 M EDTA by conductometry.
8. To determine the normality of xN  $\text{AgNO}_3$  with the help of 0.5 N NaCl by conductometry.

**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-dmk3AOfrikaFDpsZorg>
8. <https://www.youtube.com/user/PradeepKshetrapal>