School of Chemistry
Faculty of Science
University of the Punjab, Lahore
Course Outline

BS Chemistry Semester-I					
Programme	**BS (Chemistry)**	**Course Code**	**Chem-116**	**Credit Hours**	**2**
Course Title	**Fundamental Concepts of Chemical Bonding**			**Course type**	**Major**

Course Introduction

The course is organized to provide an adequate knowledge about nature and type of chemical bonding in inorganic molecules. Here is a brief description of course outlines:
Types of chemical Bonding, theories of chemical bonding, and prediction of molecular shapes VSEPR model followed by VB theory (Hybridization, Resonance etc.,) explanation of the structure of AB_2, AB_3, AB_2E, AB_4, AB_3E, AB_2E_2, AB_5, AB_3E_3, AB_6, AB_5E,AB_4E_2, AB_7, AB_6E, AB_8 and AB_9 type molecules. Discussion of molecular orbitals and molecular structures of homonuclear molecules and ions, heteronuclear diatomic and polyatomic molecules and ions. Bent bond, bridge bond, four electrons-three centre bond. Polarization of ions, Fajan's rules and its applications. Intermolecular forces e.g. Van der Waals forces and hydrogen bonding. Metallic bond on the basis of band model, Conductors, Semi-conductors and insulators

Learning Outcomes

Upon successful completion of the course, the student will be able to:

1. Acquire the basic knowledge of determining shapes of molecules.
2. Understand about intermolecular forces, bent bond and bridge bond.
3. Understand the nature of bonding in various inorganic molecules

	Course Content	Assignments/Readings
Week 1	Introduction of Chemical bonding and types of chemical bonding	Reading from recommended material
		Problem solving practice
Week 2	Theories of chemical bonding, and prediction of molecular shapes VSEPR model (AB_2 to AB_4)	Reading from recommended material
		Problem solving practice
Week 3	Theories of chemical bonding, and prediction of molecular shapes VSEPR model (AB_5 to AB_9)	Reading from recommended material
		Problem solving practice
Week 4	Theories of chemical bonding, and prediction of molecular shapes VBT model (AB_2 to AB_4)	Reading from recommended material
		Problem solving practice
Week 5	Theories of chemical bonding, and prediction of molecular shapes VBT model (AB_5 to AB_6)	Reading from lecture
		Problem solving practice
Week 6	Theories of chemical bonding, and prediction of molecular shapes VBT model (AB_7 to AB_9)	Reading from lecture
		Problem solving practice
Week 7	Discussion of molecular orbitals and molecular structures of homonuclear molecules	Reading from recommended material

		Problem solving practice
Week 8	Discussion of molecular orbitals and molecular structures of heteronuclear diatomic and polyatomic molecules and ions.	Reading from recommended material
		Problem solving practice
Week 9	Mid term Assessment	
Week 10	Bent bond, bridge bond, four electrons-three centre bond.	Reading from lecture
		Problem solving practice
Week 11	Polarization of ions, Fajan's rules and its applications.	Reading from lecture
		Problem solving practice
Week 12	Intermolecular forces e.g. Van der waals forces and hydrogen bonding.	Reading from lecture
		Problem solving practice
Week 13	Metallic bond on the basis of band model	Reading from recommended material
		Problem solving practice
Week 14	X-ray spectra and N(E) curves, n(E) curves. Binding energy in metals, conductors, semi-conductors and insulators.	Reading from lecture
		Problem solving practice
Week 15	Effect of temperature and impurities on conductivity.	Reading from lecture
		Problem solving practice
Week 16	Revision of overall aspects of bonding	Reading from recommended material
		Problem solving practice

Textbooks and Reading Material

1. Cotton, F, Albert, Goeffrey Wilkinson and Paul L. Gaus, (1995), "*Basic Inorganic Chemistry*", John, Wiley & Sons Ine, 3rd Edition.
2. Jolly, William, L., (1991), "*Modem Inorganic Chemistry*", McGraw Hill, 2nd Edition.
3. Lee, J.D., (1996), "*Modem Inorganic Chemistry*", Champan & Hall, 5th Edition.
4. Shriver, D.F., P.W. Atkins and C.H. Langford, (1996), "*Inorganic Chemistry*", Oxford, 2nd Edition.
5. Ullah, S., (2020) *"Inorganic Chemistry"*, Ilmi Kitab Khana, Lahore.
6. Rehman, R., and Bhatti, H.N., (2017), "*Advanced Inorganic Chemistry", Volume I*, Carvan Book House Lahore.

Teaching Learning Strategies

1. Lecture Based Examination (Objective and Subjective)
2. Assignments
3. Class discussion
4. Quiz
5. Tests

Assignments: Types and Number with Calendar

1. Applications of VSEPR , VBT and MOT .
2. Metallic bonding theories/Bent bond/Bridge bond/Semiconductors applications.

Assessment			
Sr. No.	**Elements**	**Weightage**	**Details**
1.	Midterm Assessment	35%	Written Assessment at the mid-point of the semester.
2.	Formative Assessment	25%	Continuous assessment includes: Classroom participation, assignments, presentations, viva voce, attitude and behavior, hands-on-activities, short tests, projects, practical, reflections, readings, quizzes etc.
3.	Final Assessment	40%	Written Examination at the end of the semester. It is mostly in the form of a test, but owing to the nature of the course the teacher may assess their students based on term paper, research proposal development, field work and report writing etc.

BS Chemistry Semester-I					
Programme	**BS (Chemistry)**	**Course Code**	**Chem-117**	**Credit Hours**	**1**
Course Title	**Inorganic Chemistry Lab**		**Course type**	**Major**	

Course Introduction

This will help the students to analyze halide ions and oxidizing samples purity in commercial samples. Here is a brief description of course outlines:

Argentometric Titrations:

Determination of amount/L of Cl^- by Mohr's Method.,

Determination of amount/L of Br^- by Mohr's Method., Determination of amount/L of Cl^- by Volhard's Method., Determination of amount/L of Br^- by Volhard's Method., Determination of amount/L of Cl^- by Adsorption Indicator Method (Fajan's Method).,Determination of amount/L of Br^- by Adsorption Indicator Method (Fajan's Method).

Iodine Titrations:

Iodimetry: Determine the amount of Iodine dissolved in water using $Na_2S_2O_3$., Determine the amount/L of KI by Iodometry., Determine the amount/L of Cu^{2+} by Iodometry. Determine the amount/L of $NaAsO_2$ by Iodometry. Determine the amount/L of NaOCl by Iodometry. Determine the amount/L of Ca(OCl)Cl by Iodometry. Determine the amount/L of H_2O_2 by Iodometry.

Learning Outcomes

On the completion of the course, the students will:

1. How to analyze chloride and Bromide in any aqueous samples.
2. How to check the purity of Copper sulphate used in agriculture and industrial plants.
3. How to check the purity of bleaching samples used in wastewater treatment plants.

Course Content		Assignments/Readings
Week 1	Introduction of Argentometry.	Solution preparations
		Lab testing practices
Week 2	Determination of amount/L of Cl- by Mohr's Method.	Solution preparations
		Lab testing practices
Week 3	Determination of amount/L of Br- by Mohr's Method.	Solution preparations
		Lab testing practices
Week 4	Determination of amount/L of Cl- by Volhard's Method.	Solution preparations
		Lab testing practices
Week 5	Determination of amount/L of Br- by Volhard's Method.	Solution preparations
		Lab testing practices
Week 6	Determination of amount/L of Cl- by Fajan's Method.	Solution preparations
		Lab testing practices
Week 7	Determination of amount/L of Br- by Fajan's Method.	Solution preparations
		Lab testing practices

Week 8	Revision and practice of argentometric titrations.	Solution preparations
		Lab testing practices
Week 9	Mid term assessment	
Week 10	Iodimetry: Determine the amount of Iodine dissolved in water using $Na_2S_2O_3$.	Solution preparations
		Lab testing practices
Week 11	Determine the amount/L of KI by Iodometry.	Solution preparations
		Lab testing practices
Week 12	Determine the amount/L of Cu^{2+} by Iodometry.	Solution preparations
		Lab testing practices
Week 13	Determine the amount/L of $NaAsO_2$ by Iodometry.	Solution preparations
		Lab testing practices
Week 14	Determine the amount/L of NaOCl by Iodometry.	Solution preparations
		Lab testing practices
Week 15	Determine the amount/L of Ca(OCl)Cl by Iodometry.	Solution preparations
		Lab testing practices
Week 16	Determine the amount/L of H_2O_2 by Iodometry.	Solution preparations
		Lab testing practices

Textbooks and Reading Material

1. Vogel, Arthur I. (2013), "*A Text-Book Of Quantitative Inorganic Analysis-Theory And Practice"*. Longmans, Green And Co.; London; New York; Toronto.
2. Rehman, R., and Bhatti, H.N., (2015), "*Experimental Inorganic Chemistry*", Carvan Book House Lahore.
3. Monim Mehboob, M., Arshad. M., and Rehman, A., (2022), "*Laboratory manual Inorganic Chemistry*" by Leads Publishing Co.
4. Rehman, R., and Bhatti, H.N., (2017) "*Advanced Experimental Inorganic Chemistry*" Carvan Book House Lahore.
5. Mendham, J., (2006), "*Vogel's textbook of quantitative chemical analysis*". Pearson Education India.

Teaching Learning Strategies

1. Lecturing
2. Written Assignments
3. Lab work

Assignments: Types and Number with Calendar

1. Argentometry and its applications
2. Iodine titrations and their applications

Assessment			
Sr. No.	**Elements**	**Weightage**	**Details**
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