**Department of Chemistry**

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Semester 2** | GEN-3201  | Expository Writing  | 3 (3-0)  | General  |
| GEN-3202  | Arabic/Kashmir Studies/Intro to History  | 2 (2-0)  | General  |
| GEN-3203  | Application of Information & Communication Technologies  | 3 (2-1)  | General  |
| BOT-3204  | Plant Systematics, Anatomy & Development  | 3 (2-1)  | Interdisciplinary  |
| ZOO-3205  | Animal Diversity-I  | 3 (2-1)  | Interdisciplinary  |
| CHM-3206  | Inorganic Chemistry  | 4 (3-1)  | Major  |

**New Scheme of Studies of BS Program (2nd semester)**

**Course Contents**

**CHM**

**-**

**3206**

**Inorganic Chemistry**

**Credit Hours: 4(3**

**-**

**1)**

**Course Objectives:** Students will not only be able to understand and acquire knowledge about basic concept of inorganic chemistry but this course will also help in developing their knowledge about the modern periodic table and basic theories of chemical bonding. This course will provide a rigorous description of chemical equilibrium phenomena and its application during chemical reactions or analysis. They will be able to understand the acid base concepts and relative strength of acids and bases. They can understand the abnormal behavior of the p-block elements, general properties and important uses of these elements and their compounds. Students will also be able to know about basic laboratory ethics and necessary precautionary measures required to carry out chemical reactions in laboratory and will be able to prepare some important compounds in the laboratory. They will also be able to analyze different radical present in the salts.

**Course Contents:**

1.**Periodicity:** Modern periodic table, similarities and differences among first row elements, their diagonal and vertical relationship with other elements, group trends and periodic properties in s, p, d and f block elements i.e., atomic radii, ionic radii, ionization potentials, electron affinities, electronegativities and redox potential.

1. **Theories of Chemical Bonding**: Nature and types of chemical bonding. Concept of valence bond theory (VBT) and molecular orbital theory (MOT), Valence shell electron pair repulsion (VSEPR) theory. Directed valence bond theory (hybridization) and their applications to homo and hetero di-atomic inorganic molecules. Metallic bonds.
2. **Acid-Base Concept**: Theories of acids and bases, applications of soft and hard acid-base (SHAB) concept. pH, pKa, pKb and their significance. Relative strength of acids and bases based on pka values. Leveling effect. Buffers, indicators and theory of indicators.
3. **Essentials of Chemical Analysis**: Law of mass action and its applications, precipitation and solubility product, common ion effect and its application, co-precipitation, fractional precipitation.
4. **Chemistry of p-Block Elements**
5. Boron and Aluminum: General characteristics, group anomalies, structure, bonding and properties of boron and aluminium hydrides.
6. Carbon and Silicon: General characteristics, comparison of carbon and silicon, allotropic forms of carbon. Structure and industrial applications of carbides, silicates and silicones. (c) Nitrogen and Phosphorus: General characteristics, group anomalies. Role of oxides of nitrogen in the environment, preparation of nitric acid and ortho phosphoric acid.

(d) Oxygen and Sulphur: General characteristics, group anomalies, role of oxides of sulphur in air pollution. Preparation of sulphuric acid. Preparation of hypo and its use in photography. (e) Halogens: General characteristics, anomalous behaviour of fluorine, industrial preparation and uses of fluorine. Structure and properties of Interhalogens and pseudohalogens.

 (f) Noble Gases: Discovery of noble gases, structure and properties of xenon fluorides, Industrial uses of noble gases and their compounds.

 6. **Chemistry of d-Block Elements:**

Electronic configuration and general characteristics of d-block elements. Industrial applications of transition metals. Werner’s concept and nomenclature of coordination compounds.

**Recommended Books**

1. Huheey, J. E., Keiter, E. A. and Keiter, R. L., “Inorganic Chemistry: Principles of Structure and Reactivity”, 4th Ed., Harper and Row, New York, 2001
2. Cotton, F. A., Wilkinson, G. and Gaus, P. L., “Basic Inorganic Chemistry”, 3rd Ed., Wiley, New York, 1995.
3. Clyde Day, M. & Selbin, J., “Theoretical Inorganic Chemistry”, 2 Reinhold, 1969.

 Van Nustrand

1. Lee, J.D., “Concise Inorganic Chemistry”, Chapman and Hall, 5
2. Shriver, D. F., Atkins, P. W. and Langford, C. H., “Inorganic Chemistry”, Oxford University Press, 2nd Edition, 1994.
3. Cartmell E. and Fowles G. W. A. “Valency and Molecular Structure” Adlard and Sons Limited 3rd Edition (1966)
4. Douglas B., McDaniel D. and Alexander J. “Concepts and Models of Inorganic Chemistry”

John Wiley & Sons, Inc. 3rd Edition (1994)

1. Harvey K. B. and Porter G. B. “Introduction to Inorganic Physical Chemistry” Addison-

Wesley Publishing Company, Inc. (1963)

1. Hill J. W. and Petrucci R. H. “General Chemistry” Prentice-Hall, Inc. (1996)
2. Marr G. and Rockett B. W. “Practical Inorganic Chemistry” Van Nostrand Reinhold

Company. (1972)

1. Miessler G. L. and Tarr Donald A. “Inorganic Chemistry” Prentice-Hall International, Inc. Prentice-Hall International Edition (1991)
2. Moody B. “Comparative Inorganic Chemistry” Routledge, Chapman and Hall, Inc. 3rd

Edition (1991)

1. Kennedy, Friedlander, “Nuclear and Radiochemistry” (latest edition).

 **Practicals**

1. Laboratory Ethics and Safety Measures: Awareness about the toxic nature of chemicals and their handling, cleaning of glassware, safe laboratory operations
2. Qualitative Analysis: Analysis of four ions (two cations and two anions) from mixture of salts.
3. Quantitative Analysis
4. Determine the %age purity of NaCl (rock salt) by Mohr's method.
5. Determination of number of water molecules (x) in CuSO4.XH2O iodometrically.
6. Determination of amount/dm3 of FeSO4.7H2O with K2Cr2O7 by both internal and external indicators.
7. Determination of %age of iron in Ferric alum (NH4)2SO4 Fe2(SO4)3.24H2O using K2Cr2O7 by both internal and external indicators.
8. Standardization of EDTA solution by Magnesium Sulfate/Zinc Sulfate solution by complexometry.
9. Find out the amount of Ca2+ in the given sample of marble (lime stone) by complexometry.

**Recommended Books**

1. Bassette, J., Denney, G. H. and Mendham, J., “Vogel’s Textbook of Quantitative Inorganic Analysis Including Elementary Instrumental Analysis” English Language Book Society, 4 Edition, 1981. th
2. Vogel, A. I., “A Textbook of Micro and Semi-micro Qualitative Inorganic Analysis” Longman Green & Co. 1995.