

# SYLLABUS OF CHEMISTRY

## SEM-III

### CCFUP UNDER NEP-2020

#### **Semester-III**

#### **Chemistry MAJOR**

Paper code: CHEM3011 (3 and 4 years)  
Paper title: Inorganic Chemistry (Theory)  
Credit: 5

#### *Course objective*

- Discussion of bonding theories (advanced parts)
- Application of the basic theories discussed so far towards coordination chemistry and s- and p-block elements

*Course outcome*

After studying several basic aspects of chemistry, students will go through their applications in studying coordination chemistry, s- and p-block elements. On studying different comparative properties s- and p-block elements, proper chemical logic will start to be developed among the students.

**1. Chemical Bonding-II**

Molecular orbital concept of bonding (The approximations of the theory, Linear combination of atomic orbitals (LCAO) (elementary pictorial approach): sigma and pi-bonds and delta interaction, multiple bonding. Orbital designations: gerade, ungerade, HOMO, LUMO. Orbital mixing, MO diagrams of  $H_2$ ,  $Li_2$ ,  $Be_2$ ,  $B_2$ ,  $C_2$ ,  $N_2$ ,  $O_2$ ,  $F_2$ , and their ions wherever possible; Heteronuclear molecular orbitals: CO, NO,  $NO^+$ ,  $CN^-$ , HF,  $BeH_2$ ,  $CO_2$  and  $H_2O$ . Bond properties: bond orders, bond lengths.

Metallic Bond: Qualitative idea of valence bond and band theories. Semiconductors and insulators, defects in solids – stoichiometric and non-stoichiometric.

Weak Chemical Forces: van der Waals forces, ion-dipole forces, dipole-dipole interactions, induced dipole interactions, Instantaneous dipole-induced dipole interactions. Repulsive forces, Intermolecular forces: Hydrogen bonding (theories of hydrogen bonding, valence bond treatment), receptor-guest interactions, Halogen bonds. Effects of chemical force, melting and boiling points. *20 Hours*

**2. Coordination Chemistry-I**

Double and complex salts. Werner's theory of coordination complexes, Classification of ligands, chelates, coordination numbers, IUPAC nomenclature of coordination complexes (up to two metal centers), Isomerism in coordination compounds, constitutional and stereo isomerism, Geometrical and optical isomerism in square planar and octahedral complexes. *12 Hours*

**3. Chemistry of s and p-block elements**

Relative stability of different oxidation states, diagonal relationship and anomalous behaviour of first member of each group. Allotropy and catenation. Study of the following compounds with emphasis on structure, bonding, preparation, properties and uses. Beryllium hydrides and halides. Boric acid and borates, boron nitrides, borohydrides (diborane) and

graphitic compounds, silanes. Oxides and oxoacids of nitrogen, phosphorus, sulphur and chlorine. Peroxo acids of sulphur. Sulphur-nitrogen compounds, Basic properties of halides and polyhalides, interhalogen compounds, pseudohalides, fluorocarbons and chlorofluorocarbons. 35 Hours

#### *Noble Gases*

Occurrence and uses, rationalization of inertness of noble gases, Clathrates; preparation, structures (VSEPR theory) and properties of  $\text{XeF}_2$ ,  $\text{XeF}_4$  and  $\text{XeF}_6$ ; Nature of bonding in noble gas compounds (Valence bond treatment and MO treatment for  $\text{XeF}_2$  and  $\text{XeF}_4$ ). Xenon-oxygen compounds. 8 Hours

#### **Reference Books**

- 1) Huheey, J. E.; Keiter, E.A. & Keiter, R.L. Inorganic Chemistry, Principles of Structure and Reactivity 4th Ed., Harper Collins 1993, Pearson, 2006
- 2) Greenwood, N.N. & Earnshaw A. Chemistry of the Elements, Butterworth-Heinemann, 1997
- 3) Cotton, F.A., Wilkinson, G., Murrillo, C. A., Bochmann, M., Advanced Inorganic Chemistry, 6th Ed. 1999., Wiley
- 4) Miessler, G. L. & Donald, A. Tarr. Inorganic Chemistry 4th Ed., Pearson, 2010
- 5) Purecell, K.F. and Kotz, J.C., An Introduction to Inorganic Chemistry, Saunders: Philadelphia, 980
- 6) Mingos, D.M.P., Essential trends in inorganic chemistry. Oxford University Press (1998)
- 7) Sarkar, R, General and inorganic chemistry, Volume II, New central book agency, (2012)

## Chemistry MAJOR

Paper code: CHEM3012 (3 and 4 Years)

Paper title: Inorganic Chemistry (Practical)

Credit: 5

### *Course objective*

- Development of chemical knowledge through several hands-on qualitative experiments
- Learning to synthesize several coordination compounds

### *Course outcome*

Towards qualitative detection of several radicals, different experiments have to be covered. These will actually grow a clear knowledge and conception in chemistry. Moreover, preparation of modern coordination compounds will create an insight to the synthetic coordination chemistry.

1. *Qualitative analysis of Acid and Basic radicals from an inorganic sample* containing four radicals (oxide, hydroxide and carbonate may not be counted among four radicals). Emphasis should be given to the understanding of the chemistry of different reactions and to assign the most probable composition. Semi-micro analysis may also be followed. The use of centrifuge machine, thioacetamide instead of H<sub>2</sub>S and spot tests for specific radicals should be introduced

Basic radicals: Na<sup>+</sup>, K<sup>+</sup>, Ca<sup>2+</sup>, Sr<sup>2+</sup>, Ba<sup>2+</sup>, Al<sup>3+</sup>, Cr<sup>3+</sup>, Mn<sup>2+</sup>/Mn<sup>4+</sup>, Fe<sup>2+</sup>/Fe<sup>3+</sup>, Co<sup>2+</sup>/Co<sup>3+</sup>, Ni<sup>2+</sup>, Cu<sup>2+</sup>, Zn<sup>2+</sup>, Pb<sup>2+</sup>, Cd<sup>2+</sup>, Bi<sup>3+</sup>, Sn<sup>2+</sup>/Sn<sup>4+</sup>, As<sup>3+</sup>/As<sup>5+</sup>, Sb<sup>3+</sup>/Sb<sup>5+</sup>, NH<sub>4</sub><sup>+</sup>, Mg<sup>2+</sup>.

Acid Radicals: F<sup>-</sup>, Cl<sup>-</sup>, Br<sup>-</sup>, I<sup>-</sup>, S<sub>2</sub>O<sub>3</sub><sup>2-</sup>, S<sup>2-</sup>, SO<sub>4</sub><sup>2-</sup>, SO<sub>3</sub><sup>2-</sup>, NO<sub>3</sub><sup>-</sup>, NO<sub>2</sub><sup>-</sup>, PO<sub>4</sub><sup>3-</sup>, AsO<sub>4</sub><sup>3-</sup>, BO<sub>3</sub><sup>3-</sup>, CrO<sub>4</sub><sup>2-</sup>.

Insoluble Materials: Al<sub>2</sub>O<sub>3</sub> (ig), Fe<sub>2</sub>O<sub>3</sub> (ig), Cr<sub>2</sub>O<sub>3</sub> (ig), SnO<sub>2</sub>, SrSO<sub>4</sub>, BaSO<sub>4</sub>, CaF<sub>2</sub>, PbSO<sub>4</sub>.

*45 Hours*

### *2. Inorganic preparations*

- 1) [Cu(CH<sub>3</sub>CN)<sub>4</sub>]PF<sub>6</sub>/ClO<sub>4</sub>
- 2) Potassium dioxalatodiaquachromate(III)
- 3) Tetraamminecarbonatocobalt(III) ion
- 4) Potassium tris(oxalato)ferrate(III)

- 5) Tris(ethylenediamine)nickel(II) chloride
- 6)  $[\text{Mn}(\text{acac})_3]$  and  $[\text{Fe}(\text{acac})_3]$  (acacH = acetylacetonone)

*30 Hours*

**Reference Books**

- 1) Vogel, A. I. Vogel's Qualitative Inorganic Analysis 7th Ed., Prentice Hall, 1996.
- 2) Karmakar, P., Sarkar (Sain), R., Ray, S., Ghosh, A.K. Concise Practical Chemistry (B.Sc. General and Honours), PART-I, The New Book Stall, Kolkata (2018).
- 3) Ghosh, Das Sharma, Majumdar, Manna, Chemistry in Laboratory, Santra Publication (P) Ltd.
- 4) Ghoshal, A., Mahapatra, B., Nad, A. K. An Advanced Course in Practical Chemistry, New Central Book Agency (2007).
- 5) Bhattacharyya, R. C, A Manual of Practical Chemistry.
- 6) K. S. Mukherjee, Textbook on Practical Chemistry, New Central Book Agency (P) Ltd.



## THE UNIVERSITY OF BURDWAN

### Minor Course under Vocational Education & Training

Course Code: MSR3021

Course Title: Medical Sales Representative –Module 1

Total Credit: 4 (Lecture -3, Tutorial -1)

Duration: 60 Hours

### Detailed Syllabus – Third Semester

#### Orientation Module (Duration: 4 Hrs.)

- Collect information of key persons at hospitals, pharmacies and dealers
- Summarize the healthcare ecosystem including relevant govt. scheme, social security benefits
- Gather information about health and other relevant standards and the possible company's tie up with various regulatory bodies and authorities
- Explain regulatory authorities and government policies, rules and regulations (CDSCO/NPPA/ MRTP Act) and their impact on business dynamics, relevant to Life Sciences industry.

#### Understand Role of MSR and Regulations for MSR (Duration: 6 Hrs.)

- Perform the occupation effectively as per company's standard guidelines
- Recall the organization structure and employment benefits in Life Sciences organizations
- Outline the role of MSR, required skills and knowledge (As per qualification pack) including its career path as well as identify the MCI code of conduct guidelines for MSR and UCP-MP Act
- Practice soft communication skills while communicating with doctors, physicians, pharmacists & cross functional colleagues.

#### Major Stakeholders and Sale & Distribution System in Pharma & Bio Pharma (Duration: 5 Hrs.)

- Follow-up with key persons at hospitals, pharmacies and dealers to ensure smooth coordination with product distribution related stakeholders
- Describe drug distribution system of pharmaceutical, vaccines, ayurvedic and homeopathic products and role of various stakeholders involved like CFA, distributor, stockist, and liasioning agents.



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**Duration: 60 Hours**

**Detailed Syllabus – Third Semester**

#### Understanding of Human Body: Anatomy and Physiology (Duration:12 Hrs.)

- Summarize technical/ scientific data presentations and briefings about product and market
- Use the basics of general anatomy, physiology, and various systems of the human body while performing the product presentation to healthcare professionals
- Correlate medical specialties and their common diseases.

#### English Speaking and Personality Development Part 1 (Duration: 33 Hrs.)

- Understanding the communication process.
- The different types of communication methods.
- Communicating in English.
- First Language (Mother Tongue) Interference.
- Importance of Listening when learning English.
- Time Management.

#### Reference Books on Medical Sales Representative

1. Community Pharmacy Handbook - Jon Waterfield
2. Essential of Pharmaceutical Chemistry - Donald Cairns
3. Pharmaceutical Innovation and Access to Medicines- OECD 2018
4. Essential of Human Physiology for Pharmacy- Laurie Kelly
5. Textbook of Organic Medicinal and Pharmaceutical Chemistry 11th edition- Wilson and Gisvold's
6. Review of Medical Physiology 26th Edition- Gannong
7. Soft Skill for everyone- Jeff Butterfeild

## INTERDISCIPLINARY COURSE

### **ENGL3031: Practical English Grammar and Usage**

[3 Cr, Full Marks: 50 (Theory: 40 + IA: 10), LH: 45 hrs]

#### **COURSE OBJECTIVES:**

This course has been designed with a view to reinforcing the students' competency in English grammar and usage as acquired at the secondary level. Already acquired linguistic skills in English will be consolidated and expanded so that students may competently use English in emerging domains of knowledge or in various socio-cultural circumstances.

#### **Parts of Speech and Usage (LH: 20)**

Nouns: Kinds of Nouns and their Usage

Pronouns: Kinds of Pronouns and their Usage

Adjectives: Kinds of Adjectives and their Usage

Articles and Determiners: Usage

Adverbs: Kinds of Adverbs and their Usage

Prepositions: Usage

Conjunctions: Usage

Verbs: Auxiliaries and Main Verbs, Modal and Semi-modal Verbs: Usage

Transitive and Intransitive Verbs: Usage

Finite and Non-Finite Verbs: Usage

#### **Sentence (LH: 15)**

Types of Sentence (Simple, Compound and Complex) and Clause and their Usage

Tense and Time

Types of Simple Sentences (Declarative, Interrogative, Imperative, Optative, Exclamatory):

Form and Function

#### **Concord (LH: 10)**

Concord of Number, Number system of Nouns and Verbs, Concord of Person, Concord System in Different Constructions

#### **COURSE OUTCOME:**

This course of study will help the students to capitalize on their acquired knowledge of English and make them comfortable in using English effectively in different social, cultural and academic situations.



**2. Fertilizer:** Different types of fertilizers. Manufacture of the following fertilizers: Urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates; polyphosphate, superphosphate, compound and mixed fertilizers, potassium chloride, potassium sulphate.

*15 hours*

3. Fungicide, pesticide, herbicide with examples, advantage and disadvantage. *10 hours*

**4. Soap & Detergents:** Different types of soap and detergents with example, surface active and surface inactive substances *10 hours*

### Reference Books

- 1) Thapar, Food Chemistry, Pacific Book International
- 2) Gayatri Baidya, Textbook of Food Chemistry, Book Rivers
- 3) Mandal, S.K., Pharmaceutical Chemistry and Production: An Introductory Textbook  
Rebeca Ghanta; Bentham Science Publishers 2022, ISBN: 978-1-68108-890-7
- 4) Sengupta, S. Application Oriented Chemistry Books Syndicate Pvt. Ltd., 2000

### SKILL ENHANCEMENT COURSE

Paper code: CHEM3051

Paper title: IT skills in Chemistry

Credit: 3

#### *Course objective*

- Development of mathematical knowledge and knowledge for computer programming
- Development of knowledge for different data handling softwares

#### *Course outcome*

The course will help the students sound for doing several chemical computations.

#### *Mathematical tools*

1. Fundamentals: mathematical functions, polynomial expressions, logarithms, the exponential function, units of a measurement, interconversion of units, constants and variables, equation of a straight line, plotting graphs.
2. Uncertainty in measurement: Displaying uncertainties, types of uncertainties, combining uncertainties. Statistical treatment. Mean, standard deviation, relative error. Data reduction and the propagation of errors. Graphical and numerical data reduction. Numerical curve fitting: the method of least squares (regression).

3. Algebraic operations on real scalar variables (e.g. manipulation of van der Waals equation in different forms). Roots of quadratic equations analytically and iteratively (e.g. pH of a weak acid). Numerical methods of finding roots (Newton-Raphson, binary-bisection, e.g. pH of a weak acid not ignoring the ionization of water, volume of a van der Waals gas, equilibrium constant expressions).

4. Differential calculus: The tangent line and the derivative of a function, numerical differentiation (e.g., change in pressure for small change in volume of a van der Waals gas, potentiometric titrations).

5. Numerical integration (Trapezoidal and Simpson's rule, e.g. entropy/enthalpy change from heat capacity data).

*15 Hours*

#### *Computer Programming*

Constants, variables, bits, bytes, binary and ASCII formats, arithmetic expressions, hierarchy of operations, inbuilt functions. Simple programs using these concepts. Matrix addition and multiplication. Statistical analysis.

Fortran or C programming for curve fitting, numerical differentiation and integration (Trapezoidal rule, Simpson's rule), finding roots (quadratic formula, iterative, Newton-Raphson method).

*15 Hours*

#### *Handling numeric data*

Spreadsheet software (Excel), creating a spreadsheet, entering and formatting information, basic functions and formulae, creating charts, tables and graphs. Incorporating tables and graphs into word processing documents. Simple calculations, plotting graphs using a spreadsheet (Planck's distribution law, radial distribution curves for hydrogenic orbitals, gas kinetic theory- Maxwell Boltzmann distribution curves as function of temperature and molecular weight), spectral data, pressure-volume curves of van der Waals gas (van der Waals isotherms), data from phase equilibria studies. Graphical solution of equations.

*15 Hours*

#### **Reference Books**

- 1) McQuarrie, D. A. Mathematics for Physical Chemistry University Science Books (2008).