

Department of Chemistry

Bethune College, Kolkata

(Affiliated to University of Calcutta)

Programme Specific Outcome (PSO) & Course Outcome (CO)

Name of the Programme: B.Sc. CHEMISTRY Honours (Under CBCS)

Year of Introduction: Session 2018-19

Programme Specific Outcome (PSO):

- **PSO 1.** Students will be entirely equipped with the knowledge of all the branches of Chemistry such as physical, inorganic, organic & analytical chemistry.
- **PSO 2.** Students will acquire the ability to analyse and explain chemical phenomena with the basic principles and fundamentals and to write it concisely.
- **PSO 3.** Students will learn to analyse inorganic and organic samples qualitatively and in some cases quantitatively.
- **PSO 4.** Students will gain expertise to set up an experiment (estimation or synthesis of a compound) and work up.
- **PSO 5.** Students will be enriched with the knowledge and training to operate many physico-chemical instruments and to carry out experiments there in.
- **PSO 6.** Students will be able to interpret IR and NMR spectra of organic compounds.
- **PSO 7.** Students will attain the ability to work individually or in a group following a systematic plan.
- **PSO 8.** Introduction of Computer under CBCS at the UG level will upgrade the Quality of Education of the students.
- **PSO 9.** Students will achieve the confidence to prepare and defend a scientific presentation in their individual capacity.

Course Outcome (CO):

A. CORE COURSE

Sem-1

CEMA-CC-1-1 – INORGANIC CHEMISTRY-1 ORGANIC CHEMISTRY -1A

- **CO 1.** Students will be acquainted with the basic concepts of atomic structure, acid-base & redox reactions in Inorganic Chemistry as well as the fundamentals of Organic Chemistry like bonding, physical properties & reaction mechanisms.
- **CO 2.** Inorganic practical will illustrate redox reactions and acid-base reactions to the students. Also the experiments on separation of binary mixture based upon solubility will enable the students to identify the nature and classification (acidic, basic or neutral) of organic compounds.

CEMA-CC-1-2 – PHYSICAL CHEMISTRY-1 ORGANIC CHEMISTRY -1B

- **CO 1.** Students will learn the knowledge of kinetic theory, chemical kinetics, basic stereochemistry & reactive intermediates.

- **CO 2.** Physical Chemistry experiments and calculation of results with Excel will benefit the students. Also they will learn boiling point determination of different liquids.

Sem-2

CEMA-CC-2-3 – ORGANIC CHEMISTRY-2

- **CO 1.** Students will have detailed understanding in various advanced aspects of stereochemistry, reaction energetics and mechanism (substitution & elimination).
- **CO 2.** Students will acquire enhanced skill in preparation, purification, melting point determination and yield calculation of various compounds by different methodology of Organic Chemistry Practical.

CEMA-CC-2-4 – INORGANIC CHEMISTRY-2

- **CO 1.** Students will be introduced to the concept of bonding- both ionic and covalent in details, and also radioactivity.
- **CO 2.** Students will continue to learn experiments on advanced redox reactions. They will also learn how to estimate metals from alloys.

Sem-3

CEMA-CC-3-5 – PHYSICAL CHEMISTRY-2

- **CO 1.** Students will get the updated ideas of Thermodynamics and Electrochemistry.
- **CO 2.** Students will be enriched with the knowledge of Conductometric and Potentiometric experiments with Excel programming.

CEMA-CC-3-6 – INORGANIC CHEMISTRY-3

- **CO 1.** Students will be introduced to the topic like chemical periodicity and subsequently they will learn group chemistry and coordination chemistry in details.
- **CO 2.** Students will learn to carry out complexometric titration and chromatographic separation of mixture of metal ions. They will also be enriched with the idea of gravimetric estimation.

CEMA-CC-3-7 – ORGANIC CHEMISTRY-3

- **CO 1.** Students will be acquainted with the chemistry of alkenes, alkynes, carbonyls, aromatics & organometallics. Most importantly, they will learn the concept of C-C bond formation and bond breaking, required for synthetic organic chemistry.
- **CO 2.** Identification of solid and liquid compounds and quantitative estimations will improve the experimental skills of the students.

Sem-4

CEMA-CC-4-8 – ORGANIC CHEMISTRY-4

- **CO 1.** Students will acquire in-depth knowledge in the logic of organic synthesis, nitrogen compounds, rearrangement reactions & organic spectroscopy, which will help them to understand designing of synthetic routes and its viability.

- **CO 2.** Qualitative analysis of single solid organic compounds and derivative preparation will develop student's practical skill as well as the understanding of organic reactions.

CEMA-CC-4-9 – PHYSICAL CHEMISTRY-3

- **CO 1.** Students will be enriched with the knowledge of solution chemistry, solids, quantum chemistry and phase equilibrium.
- **CO 2.** Students will be trained in polarimetric, pH-metric and phase rule-based experiments.

CEMA-CC-4-10 – INORGANIC CHEMISTRY-4

- **CO 1.** Students will learn coordination chemistry in details along with chemistry of d- and f-block elements. Reaction kinetics and mechanism are also taught here.
- **CO 2.** Students will be acquainted with inorganic preparations and will learn the use of spectrophotometer in practical.

Sem-5

CEMA-CC-5-11 – PHYSICAL CHEMISTRY-4

- **CO 1.** Students will be enriched with advanced ideas in the field of quantum chemistry, statistical thermodynamic and computer based numerical analysis.
- **CO 2.** Students will be accustomed with various computer-based experiments that is a modern approach of Chemistry.

CEMA-CC-5-12 – ORGANIC CHEMISTRY-5

- **CO 1.** Students will develop concepts in diverse chemistry of heterocycles, polynuclear hydrocarbons and biomolecules, which constitute most of the natural products. Moreover knowledge of cyclic stereochemistry and FMO approach in pericyclic reactions will complete the foundation of Organic Chemistry.
- **CO 2.** Students will learn the different types of chromatographic separation techniques which will develop an all-round skill. Moreover, implementation of IR and NMR spectroscopy and their applications will introduce the idea of research.

Sem-6

CEMA-CC-6-13 – INORGANIC CHEMISTRY-5

- **CO 1.** Students will have the concept of chemistry behind qualitative inorganic analysis. They will also learn about Bioinorganic Chemistry and Organometallic Chemistry.
- **CO 2.** Students will learn qualitative semimicro analysis of inorganic mixtures having three radicals with special emphasis on understanding of the chemistry of different reactions therein.

CEMA-CC-6-14 – PHYSICAL CHEMISTRY-5

- **CO 1.** Students will be enriched with the knowledge of spectroscopy, photochemistry, surface chemistry & polarisation to complete their knowledge of physical chemistry.

- **CO 2.** Students will gain practical experience in performing experiments on spectrophotometry and surface chemistry which will help to educate students to a large extent.

B. DISCIPLINE SPECIFIC ELECTIVE COURSE

Sem-5

CEMA-DSE A2 - APPLICATIONS OF COMPUTERS IN CHEMISTRY

- **CO 1.** Students will be benefited with the knowledge of computer applications in understanding various aspects of physical chemistry through plots and spreadsheets.

CEMA-DSE B1 - INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE

- **CO 1.** Students will be introduced to some materials and processes important in industries. Practical will include different types of estimation and analysis of industrially important compounds.

Sem-6

CEMA-DSE A3 - GREEN CHEMISTRY AND CHEMISTRY OF NATURAL PRODUCTS

- **CO 1.** Students will learn to use simple nontoxic chemicals for synthesis as is found in Mother Nature.
- **CO 2.** Students will understand the necessity of minimising toxic waste generation and reducing environmental pollution, which are very relevant in today's perspective.
- **CO 3.** Practical experiments in this course will give students the required expertise which will make them more familiar with the current research field.
- **CO 4.** Students will be motivated to use sunlight as energy source, water as reaction medium and natural biomolecules as catalyst to carry out organic synthesis in environmentally benign way.

CEMA-DSE B3 – POLYMER CHEMISTRY

- **CO 1.** Students will understand the nature, structure, morphology and crystallisation of polymers. They will know about the details of kinetics and thermodynamics of polymer as well as their glass transition temperature and melting temperature.
- **CO 2.** Students will study the preparation, properties and application of different polymers including addition, condensation and copolymerisation process.
- **CO 3.** In the practical part, students will learn experimentally how to characterise and analyse a polymer or its different materials. They will also be trained in the synthesis of different polymers and understanding the reaction conditions.

C. SKILL ENHANCEMENT COURSE

Sem-3

CEMA – SEC A2 - ANALYTICAL CLINICAL BIOCHEMISTRY

- **CO 1.** Students will gain the knowledge in chemistry of various biomolecules and Biochemistry of disease through a detailed theoretical course structure.

Sem-4

CEMA – SEC B3 - PHARMACEUTICALS CHEMISTRY

- **CO 1.** Students will attain enhanced knowledge of drug design, development, synthesis & mechanism of action of different drugs and production of important molecules by fermentation.

D. GENERIC ELECTIVES

Sem-1

CEMG – GE-1

- **CO 1.** Students will be introduced to basic concepts of kinetic theory of gases and real gases, liquids, chemical kinetics, atomic structure, chemical periodicity, acids and bases, fundamentals of organic stereochemistry, nucleophilic substitution and elimination reactions to the students.
- **CO 2.** Students will learn different types of estimation using the knowledge of acid-base titration, permanganometry, dichromatometry and iodometry.

CEMG – GE-2

- **CO 1.** Students will gain knowledge in thermodynamics, chemical equilibrium, solutions, phase equilibria, solids, aliphatic hydrocarbons, error analysis & computer applications and redox reactions.
- **CO 2.** Students will have practical knowledge of kinetics, viscosity, surface tension and solubility product using different apparatus.

CEMG – GE-3

- **CO 1.** Students will be motivated to have a comprehensive view of chemical bonding and molecular structure including ionic bonding, covalent bonding and MO approach. They will also learn comparative study of p-block and transition elements (3d series) along with coordination chemistry and electrochemistry. It will enrich students with the basic understanding of aromatic hydrocarbons, organometallic and aryl halides.
- **CO 2.** Students will learn to do qualitative semi-micro analysis of mixtures containing two radicals in practical classes with emphasis on the chemistry of different reactions.

CEMG – GE-4

- **CO 1.** Students will study chemistry of organic compounds (alcohols, phenols, ethers, carbonyls, carboxylic acids & their derivatives, amines & diazonium salts, amino acids and carbohydrates), the concept of crystal field theory, quantum chemistry & spectroscopy.
 - **CO 2.** In this module, students through practical classes will learn qualitative analysis of single solid organic compound(s) which will improve their practical skill as well as the understanding of organic reactions. They will also gain the knowledge of identification of a pure organic compound.
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