

DUM DUM MOTIJHEEL COLLEGE

Undergraduate Department of Chemistry

Programme Specific Outcomes

B.Sc. Chemistry (Hons) CBCS Syllabus

With Effect from 2018-19

At the completion of this programme, students will be able to

- **PSO1:** Comprehend the fundamental ideas, principles applications of physical, organic and inorganic chemistry
- **PSO2:** Set up physicochemical experiments, analyse observed data, create graphs, compute physical constants and interpret the outcomes
- **PSO3:** Analyse inorganic compounds qualitatively, estimate solutions and mixtures quantitatively and acquire proficiency in utilizing analytical instruments
- **PSO4:** Identification/Preparation, Qualitative/ Quantitative/ Spectroscopy analysis of single organic compounds and chromatographic separation of mixtures and also study of green synthesis are all included..
- **PSO5:** Learn computer programs based on numerical methods
- **PSO6:** Creation and demonstration of a power point presentation on the relevant topics well-read throughout the program.
- **PSO7:** Collaborate effectively in a group and become familiar with the safety measures and upkeep procedures of a chemistry lab.

Dum Dum Motijheel College
Course Outcome or Learning Outcome
Three year B.A./B.Sc degree Course
Under CBCS Semester System
HONOURS COURSE IN CHEMISTRY
With effect from the session: 2020-21

Course Name: Course Course-1
Course Code: CEMACOR01T & CEMACOR01P
Topic Name: Organic Chemistry-1
Course Outcome **At the end of this course a student learns**

1. Basics of bonding and physical properties, Valence bond theory, electronic displacements, MO theory
2. General treatment of reaction mechanism like mechanistic classification and reactant intermediates
3. Stereochemistry of carbon compounds-bonding geometries, concept of chirality and symmetry, relative and absolute configuration, optical activity of chiral compounds
4. To identify and separate some organic compounds (solid & liquid) in the practical paper

Course Name: Course Course-2
Course Code: CEMACOR02T & CEMACOR02P
Topic Name: Physical Chemistry-1
Course Outcome **At the end of this course a student learns**

1. Kinetic Theory of gases, Maxwell's distribution of speed and energy and real gas and virial equation
2. The three laws of thermodynamics, understanding the spontaneity of a reaction, chemical equilibria, principle of thermochemistry and various thermodynamic reaction
3. Order of reactions, factors affecting the rate, molecularity, theory of reaction rates, principles of homogeneous catalysis
4. Physicochemical experiments based on thermochemistry, kinetics and determination of pH of a buffer (colour matching)

Course Name: Course Course-3
Course Code: CEMACOR03T & CEMACOR03P
Topic Name: Inorganic Chemistry-1
Course Outcome **At the end of this course a student learns**

1. Atomic structure based on Bohr, Sommerfeld and wave mechanical model, electronic configuration and ground state term symbol of elements
2. Modern IUPAC periodic table and periodicity in various physical properties such as IE, EA and electronegativity, outcome of inert pair effect and Lanthanide contraction
3. Various concepts regarding acidity and basicity, SHAB principle, pH, buffer, indicator
4. Chemical reaction balancing, redox potential diagram, solubility product principle and its effect
5. Quantitative estimation of metal ions by redox titrations and mixture of compounds based on acid-base titration

Course Name: Course Course-4
Course Code: CEMACOR04T & CEMACOR04P
Topic Name: Organic Chemistry-II
Course Outcome **At the end of this course a student learns**

1. Chirality arising out of stereocenter, Concept of prostereoisomerism, Conformational analysis
2. Reaction thermodynamics, Concept of organic acids and bases, Tautomerism and Organic Reaction kinetics, isotope effect
3. Free-radical substitution reaction, Nucleophilic substitution reactions, Elimination reactions
4. Synthesis of some organic compound, their purification, percentage yield calculation and melting point determination

Course Name: Course Course-5
Course Code: CEMACOR05T & CEMACOR05P
Topic Name: Physical Chemistry-II
Course Outcome **At the end of this course a student learns**

1. Fick's law governing the transport processes like diffusion, viscosity and conductance, applications of viscosity and conductance measurement
2. Partial properties and Chemical potential, Chemical Equilibrium, Chemical potential and other properties of ideal substances- pure and mixtures, Condensed Phase
3. Basics of Quantum Mechanics: Wave function, Concept of Operators, Particle in a box, Simple Harmonic Oscillator
4. Experiments based on conductometry, viscosity and partition coefficient

Course Name: Course Course-6
Course Code: CEMACOR06T & CEMACOR06P
Topic Name: Inorganic Chemistry-II

Course Outcome At the end of this course a student learns

1. Concept of Ionic bond and Covalent bond and their role in explaining structure and chemical properties of compounds
2. Molecular orbital concept of bonding in explaining bond order and magnetic properties
3. Metallic Bond
4. Weak Chemical Forces and hydrogen bonding and its role in biology
5. Radioactivity: Nuclear stability and nuclear binding energy, hazards and safety measures of radiation
6. Iodometric titration for estimation of Cu, Vit C, arsenite & available chlorine and estimation of metal ions in alloys and cement

Course Name: Course Course-7
Course Code: CEMACOR07T & CEMACOR07P
Topic Name: Organic Chemistry-III

Course Outcome At the end of this course a student learns

1. Chemistry of alkenes and alkynes : Addition to $C=C$ and $C\equiv C$
2. Different Electrophilic and Nucleophilic aromatic substitution reaction
3. Carbonyl and Related Compounds: Addition to $C=O$, Exploitation of acidity of α -H of $C=O$, Elementary ideas of Green Chemistry Nucleophilic addition to α,β -unsaturated carbonyl system, Substitution at sp^2 carbon ($C=O$ system)
4. Grignard reagent; Organolithiums; Gilman cuprates in organometallics
5. Qualitative Analysis of Single Solid Organic Compounds

Course Name: Course Course-8
Course Code: CEMACOR08T & CEMACOR08P
Topic Name: Physical Chemistry-III

Course Outcome At the end of this course a student learns

1. Application of Thermodynamics in Colligative properties, Phase rule and Binary solutions
2. Electrical Properties of molecules such as Ionic equilibria Electromotive Force, Dipole moment and polarizability
3. Quantum mechanical treatment of Angular momentum, Qualitative treatment of hydrogen atom and hydrogen-like ion, LCAO and HF-SCF
4. Physicochemical experiment on potentiometry, pH-metry, solubility product and phase rule

Course Name: Course Course-9
Course Code: CEMACOR09T & CEMACOR09P
Topic Name: Inorganic Chemistry-III

Course Outcome At the end of this course a student learns

1. The principles of extracting pure metals from their ores
2. Chemistry compounds of s and p block elements and comparative studies of their properties
3. Preparation and Properties of noble gas compounds and inorganic polymers
4. Coordination chemistry, IUPAC nomenclature and isomerism
5. Estimation of metal ions by complexometric titration and preparation of some inorganic complexes.

Course Name: Course Course-10
Course Code: CEMACOR10T & CEMACOR10P
Topic Name: Organic Chemistry-IV

Course Outcome At the end of this course a student learns

1. Nitrogen compounds: Amines and Nitro compounds (aliphatic and aromatic), Alkyl nitrile and isonitrile, Diazonium salts and their related compounds
2. Mechanism with evidence and stereochemical features for Rearrangement to electron-deficient carbon, electron-deficient nitrogen, electron-deficient oxygen, Aromatic rearrangements, Migration from nitrogen to ring carbon and Rearrangement reactions by green approach
3. Retrosynthetic analysis, Strategy of ring synthesis, Asymmetric synthesis
4. Principles of Organic Spectroscopy: UV Spectroscopy, IR Spectroscopy, NMR Spectroscopy
5. Quantitative Estimations of various organic compounds

Course Name: Course Course-11
Course Code: CEMACOR11T & CEMACOR11P
Topic Name: Inorganic Chemistry-IV

Course Outcome At the end of this course a student learns

1. Advanced coordination chemistry: Calculation of CFSE, OSSE, JT distortion, MO concept, magnetism and spectral properties
2. Properties of transition elements, lanthanides and actinoids
3. Chromatographic separation of metal ions, gravimetric estimation, spectrophotometric determination of $10Dq$

Course Name: Course Course-12
Course Code: CEMACOR12T & CEMACOR12P
Topic Name: Organic Chemistry-V
Course Outcome **At the end of this course a student learns**

1. Polynuclear hydrocarbons and their derivatives, Heterocyclic compounds
2. Cyclic Stereochemistry
3. Pericyclic reactions: Mechanism, stereochemistry, regioselectivity in case of Electrocyclic reactions, Cycloaddition reactions
4. Carbohydrates: Monosaccharides and Disaccharides
5. Biomolecules: Amino acids, Peptides and Nucleic acids
6. TLC, Column chromatographic and Paper chromatographic separation of mixture of organic compounds

Course Name: Course Course-13
Course Code: CEMACOR13T & CEMACOR13P
Topic Name: Inorganic Chemistry-V
Course Outcome **At the end of this course a student learns**

1. Bioinorganic Chemistry: Role of Essential and beneficial elements, functioning of different proteins and enzymes and role of metals in medicine
2. Preparation, structure and functioning of organometallic compounds and their catalytic role in industrial reactions
3. Kinetics and mechanism of inorganic reactions
4. Qualitative detection of different cations and anions in practical classes

Course Name: Course Course-14
Course Code: CEMACOR14T & CEMACOR14P
Topic Name: Physical Chemistry-IV
Course Outcome **At the end of this course a student learns**

1. Molecular Spectroscopy: Principle and applications of Rotational, Vibrational, Raman, NMR and ESR spectroscopy
2. Photochemistry: Laws of photochemistry, different photochemical processes their kinetics and role of such reactions in biochemical processes
3. Surface phenomenon: Surface tension and energy, different adsorption isotherms, stability of colloids, their electrokinetic phenomenon, applications and micelle formation
4. In practical classes, determination of surface tension and its application to measure the CMC of a surfactant, kinetic study of a reaction spectrophotometrically and verification of Lambert-Beer law

Course Name: Discipline Specific Elective-1
Course Code: CEMADSE01T & CEMADSE01P
Topic Name: Advanced Physical Chemistry

Course Outcome At the end of this course a student learns

1. Crystal Structure: Bravais Lattice and Laws of Crystallography, Crystal planes and determination of Crystal structure
2. Statistical Thermodynamics: Configuration, Boltzmann distribution and Partition function
3. Specific heat of solid, 3rd law of thermodynamics, classification, nomenclature, texture of Polymers and molecular forces and conducting polymers
4. In practical classes, Computer programs based on numerical methods for such as Roots of equations, Numerical differentiation and integration, Matrix operations etc.

Course Name: Discipline Specific Elective-2
Course Code: CEMADSE02T & CEMADSE02P
Topic Name: ANALYTICAL METHODS IN CHEMISTRY

Course Outcome At the end of this course a student learns

1. Qualitative and quantitative aspects of analysis like Sampling
2. evaluation of analytical data
3. Optical methods of analysis: UV-Vis, IR, Flame Atomic Absorption and Emission spectroscopy and their application in estimation of metal ions, geometrical isomers, keto-enol tautomerism, Techniques for the quantitative estimation of trace level of metal ions from water samples.
4. Theory of thermogravimetry and techniques for quantitative estimation of Ca and Mg from their mixture
5. Electroanalytical methods to determine equivalence points and pKa values
6. Separation techniques such as Solvent extraction and chromatographic methods of analysis: IC, GLC, GPC, TLC and HPLC.
7. In practical classes, separation of mixtures by different chromatographic methods, Solvent Extraction of Ni(II) & Fe(II) ions and analysis of soil

Course Name: Discipline Specific Elective-3
Course Code: CEMADSE04T & CEMADSE04P
Topic Name: Green Chemistry

Course Outcome At the end of this course a student learns

1. About concept of green chemistry and 12 principles of green chemistry, Atom Economy, Prevention of waste and minimization of Risk.
2. Green solvents and their uses in organic Reactions (Including Water), Ionic Liquids and Solventless Processes, Concept of alternative sources of Energy, Use of catalytic reagents and Concept Of ISD.
3. Green synthesis of some organic compounds including Microwave assisted reactions in water, An efficient green synthesis of PLA made from corn, concept of green chemistry of healthier fats and oils and Oxidation Reagents and future trends of Green chemistry in Sustainable development.
4. Selection of starting materials and Surfactants for carbon dioxide
5. In practical classes they will also do some effective green reactions (hand to hand) using green solvents water and synthesis of some bioactive Schiff Bases. Photochemical Reactions and Preparation of bio-diesel, Benzoin condensation using Thiamine Hydrochloride as a catalyst instead of cyanide

Course Name: Discipline Specific Elective-4
Course Code: CEMADSE05T & CEMADSE05P
Topic Name: INORGANIC MATERIALS OF INDUSTRIAL IMPORTANCE

Course Outcome At the end of this course a student learns

1. Silicate Industries: Glass, Ceramics, Cements-Manufacturing process, composition and their applications
2. Different types of fertilizers: preparations and uses.
3. Objectives of surface coatings: classification, Paints and pigments, Special paints, metal spraying and anodizing
4. Construction and working principle of industrially important batteries
5. Classification, specific properties, manufacture and uses of alloys
6. General principles and properties of catalysts, application of zeolites as catalysts
7. Preparation and explosive properties of lead azide, PETN, cyclonite (RDX) and introduction to rocket propellants
8. In practical classes, Estimation of free acidity in ammonium sulphate fertilizer, Calcium in Calcium ammonium nitrate fertilizer of phosphoric acid in superphosphate fertilizer, analysis of Cement and alloys

Course Name: Skill Enhancement Course-1

Course Code: CEMSSEC01M

Topic Name: Basic Analytical Chemistry

Course

At the end of this course a student learns

Outcome

1. Introduction to Analytical Chemistry, concept of sampling, accuracy, precision, sources of error
2. Analysis of soil: Composition, Estimation of Calcium and Magnesium ions complexometrically
3. Analysis of water: water sampling and purification methods
4. Nutritional value of foods, idea about food processing and food preservations and adulteration
5. Definition, general introduction on principles of chromatography, paper chromatography, TLC, ion exchange
6. Major and minor constituents of cosmetics and their function

Course Name: Skill Enhancement Course-2

Course Code: CEMSSEC02M

Topic Name: ANALYTICAL CLINICAL BIOCHEMISTRY

Course

At the end of this course a student learns

Outcome

1. Structure and their biological importance of Carbohydrates, Proteins, Enzymes (biocatalysis), lipids, lipoproteins, DNA, RNA
2. Biochemistry of disease: Composition and functions of blood estimation and interpretation of data for blood sugar, urea, creatinine, cholesterol and bilirubin, Composition and estimation of constituents of normal and pathological urine

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Three year B.Sc. degree course
Under CBCS semester system
GENERAL COURSE IN CHEMISTRY
WITH effect from the session :2018-2019

Course Name: Generic Elective/Discipline Specific Elective course-1(Inorganic-1,Organic -1)

Course code: CEMHGECO1T and CEMHGECO1P/CEMGCOR1T & CEMGCOR01P

Topic name: Atomic structure ,Chemical periodicity ,Acid and base, Redox reactions, General organic chemistry & Aliphatic hydrocarbons

Course outcome -At the end of the course of both theory and practical ,the students will learn the followings,

- 1 Fundamental of quantum mechanics & Atomic structure ,chemical periodicity, Chemistry of acid and base &Details of redox reaction
- 2 Fundamental of organic chemistry & concept of stereochemistry Elementary mechanistic aspects of nucleophilic substitution & elimination reactions ,Fundamental group approach of aliphatic hydrocarbons.
- 3 In practical classes ,they will do estimation of sodium carbonate and sodium bicarbonate present in a mixture ,Estimation of oxalic acid, water of crystallisation in Mohr's salt , Estimation of iron(II) and Copper(II) ions by different method.
- 4 In practical classes they will also learn qualitative analysis of single organic compounds(functional group analysis of each compound).

Course Name: Generic Elective/ Discipline Specific Elective course -2(Physical -I ,Inorganic-II)

Course code:CEMHGECO2T and CEMHGECO2P/CEMGCOR2T & CEMGCOR02P

Topic name: States of matter and chemical kinetics ,Chemical bonding & molecular structure, P-block elements

Course outcome -At the end of the course of both theory and practical, ,the students will learn the followings and develops the idea

- 1 The general behaviour and properties of the different state of matter
Ex-solid , liquid and gas.
- 2 The different factors that affect the rate of a chemical reaction and the methods of determination of rate and order.
- 3 The various types of bonding involved in a molecular structure and concept of resonance.
- 4 Properties and reactions of P-block elements.
- 5 In regular practical classes ,they will learn hands on experience in qualitative analysis of inorganic samples and measurement of properties of liquids (viscosity, surface tension etc).

Course Name: Generic Elective/ Discipline Specific Elective course -3(Physical-II,Organic - II)

Course code: CEMHGECO3T and CEMHGECO3P/CEMGCOR3T & CEMGCOR03P

Topic Name: Chemical Energetics, Equilibria, Organic Chemistry-II

- 1 The basic principle and law of thermodynamics.
- 2 The concept of chemical equilibrium and the factors affecting it
- 3 Idea about Ionic equilibrium, pH scale and solubility and application of solubility product.
- 4 Preparation and properties and chemical reactions of organic compounds like alcohols, phenols, ethers ,carbonyl compounds.
- 5 Chemistry of aromatic hydrocarbon(benzene) and organometallic compounds.
- 6 In practical classes ,they will learn some experiments on thermochemistry and ionic equilibrium and identification of pure organic compound(solid and liquid).

Course Name: Generic Elective/ Discipline Specific Elective course (Physical-III,Analytical and environment)

Course code: CEMHGECO4T and CEMHGECO4P/CEMGCOR4T & CEMGCOR04P

Topic name : Solutions, Phase Equilibria, Conductance, Electrochemistry & analytical and environmental chemistry- 1

Course outcome -At the end of the course of both theory and practical module ,the students will learn the followings,

- 1 Understand the fundamental concept of basic physical chemistry based on solution , phase equilibrium ,conductance and electromotive force .They will also acquainted with the problems solving technique based on aforesaid physical phenomenon.
- 2 Understand few analytical concepts based on gravimetric and volumetric analysis. Side by side they will also acquainted with chromatographic methods of analysis using column and thin layer chromatography .They will also acquire some knowledge on environmental chemistry ,related pollution and their consequences.
- 3 They will also perform some practical classes based on aforesaid knowledge.

Course Name: Discipline Specific Elective course 1 (Green chemistry)

Course code: CEMGDSE02T & CEMGDSE02P

Topic name: Introduction to green chemistry , Green solvents and green reactions.

Course outcome -At the end of the course of both theory and practical module , the students will learn the followings and develop knowledge

- 1 About concept of green chemistry and 12 principles of green chemistry, Atom Economy, Prevention of waste and minimization of Risk.
- 2 Green solvents and their uses in organic Reactions (Including Water), Ionic Liquids and Solventless Processes, Concept of alternative sources of Energy, Use of catalytic reagents and Concept Of ISD.
- 3 Green synthesis of some organic compounds including Microwave assisted reactions in water, An efficient green synthesis of PLA made from corn, concept of green chemistry of healthier fats and oils and Oxidation Reagents and Green chemistry in Sustainable development.
- 4 In practical classes they will also do some effective green reactions (hand to hand) using green solvents water and synthesis of some bioactive Schiff Bases. Photochemical Reactions and Preparation of bio-diesel.

Course Name : Discipline Specific Elective course -2

Course Code : CEMGDSE03T & CEMGDSE03P

Topic Name: Inorganic Materials Of Industrial Importance

Course Outcome: After studying the course, both theory and practical, the following outcome is expected

- 1 Learning the procedure of preparation of cement , ceramics and glass and their applications
- 2 Learning the procedure of preparation of important fertilizers, paints and pigments.
- 3 . Learning the procedure of preparation of different types of batteries and alloys and their properties
- 4 Learning the utility of using different catalysts in different chemical reactions.
- 5 Learning of different kinds of explosives.
- 6 Hands on experiment in analyzing useful materials like fertilisers ,cement, plastic etc.