

DEPARTMENT OF CHEMISTRY
CERTIFICATE COURSE
SYLLABUS

SEMESTER 1

FUNDAMENTAL CHEMISTRY

COURSE OUTLINE

Module-1: Science, Methods and Tools of Science. **8hrs**

Understanding of science and culture-Laws of science – Basis for scientific laws and factual truths -Revolution in science-Hypothesis –Observations and proofs –Revision of scientific theories and laws – Process and product of science – Acquisition of various basic process skills of science.

Module-2:ExperimentationinScience. **8hrs**

Design of an experiment –Experimentation-Observation –Data collection – Documentation of experiments –Nature and types of data –Types of experiments-Choice and selection of instruments –Types of instrumentation – Accuracy and precision.

Module-3: Evolution of Chemistry as a Discipline of Science. **8hrs**

Evolution of chemistry – Early form of Chemistry –Alchemy –Robert Boyle and origins of modern chemistry – Origin of modern Chemistry –Role of chemistry as a central science –Basic ideas of interdisciplinary areas involving chemistry .

Module-4: Different Models of Chemistry. **6hrs**

Background and thought of John Dalton –Atom models; Daltons, J.J Thomson, Rutherford, Bohr model –Major contributions of Friedrich Wohler, Dmitri Mendeleev and Michael Faraday.

SEMESTER 2

INDUSTRIAL PROCESSES AND WASTE MANAGEMENT

Module I: Principles of chemical technology: 8 hrs

Introduction basic principles of chemical technology importance of chemical technology classification of technological process designing and modeling of chemical plants-unit process and unit operations.

Module II: Industrial unit processes: 12 hrs

Basic principles of distillation solvent extraction - solid-liquid leaching and liquid liquid extraction separation by absorption and adsorption. An introduction into the scope of different types of equipment needed in chemical technology. Scaling up operations in chemical industry - Introduction to clean technology.

Module III: Environmental management: 4hrs

Introduction-definition-Cause of pollution, types of pollution such as air and water pollution

Module IV: Industrial hazards and safety measures: 6 hrs

Safety signs and colours used in industries- Industrial hazards - Definition - Chemical hazard Dust hazard - Electrical hazard- Preventive measures.

SEMESTER 3

CHEMISTRY IN LIVING SYSTEM

COURSE OUTLINE

Module -1: Volumetric Analysis.

8hrs

Introduction –Primary and secondary standards – Standard solutions – Theory of titrations involving acids and bases –Indicators; Adsorption and complexometric indicators –Double burette method of titration; Principle and advantages.

Module-2: Periodic properties.

8hrs

Law of triads- Octaves- X-ray studies of Henry Mosley- Mosleys periodic law- Modern periodic law- Long form of periodic table- Periodicity in properties; atomic and ionic radii.

Ionization enthalpy-Electron affinity- Electronegativity; Pauling and Mulliken scale- Effective nuclear charge- Slater rule and its applications- Polarising power- Fajans rule.

Module-3: Chemical and renewable energy sources.

10 hrs

Principles and applications of primary and secondary batteries and fuel cells- Basics of solar energy.

Polymers- Basic concept of polymers- Classification and characteristics of polymers- Application of polymers as plastic in electronics, automobiles components, medical fields and aerospace materials- Problems of plastic waste management- Strategies for the development of environmental friendly polymers.

Module-4: Enzymes and correlation with drug action.

4hrs

Mechanism of Enzyme action- Factors affecting enzyme action- Coenzymes and cofactors- Specificity of enzyme action- Enzyme inhibitors and their importance- Phenomenon of inhibition.

Drug action-Receptor theory (Elementary idea only)

SEMESTER 4

CHEMICAL INDUSTRIES

Module-I: Surface Coatings: 14 hrs

Objectives of coatings surfaces, preliminary treatment of surface, classification of surface coatings. Paints and pigments-formulation, composition and related properties. Oil paint, Vehicle, modified oils, Pigments, toners and lakes pigments, Fillers. Thinners, Enamels, emulsifying agents. Special paints (Heat retardant. Fire retardant, Eco-friendly paint, Plastic paint), Dyes, Wax polishing, Water and Oil paints, additives, Metallic coatings (electrolytic and electroless), metal spraying and anodizing. (Elementary ideas only).

Module-II: Pesticides: 6hrs

Introduction methods of pest controls methods of using pest controls-lead arsenate, paris green, DDT, gammaxane- Adverse environmental effects of pesticides.

Module - III: Chlor-Alkali Industry: 3hrs

Manufacture of Soda ash, Caustic Soda, Chlorine & Hydrogen.

Module IV: Sugar Industries: 7 hrs

Sugar industry in India - Sugar cane and sugar beet Manufacture of cane sugar - Ethanol from molasses by fermentation-manufacture of wine, beer, methylated spirit.

SEMESTER 5

INDUSTRIAL CHEMISTRY

COURSE OUTLINE

MODULE-1: Natural textile fiber and viscous fiber. **8 hrs**

Natural textile fibers; Definition, classification of natural textile fibers- Vegetable fibers, Animal fibers- Properties- uses and features of cotton, wool, silk and jute fibers- Generally modified cotton- Merits and demerits

Viscous fiber; Chemical structure- Chemistry of regenerated cellulose- Production of viscous fibers- Properties and uses of viscous fiber.

MODULE-2: Synthetic and acrylic fibers. **8 hrs**

Synthetic fibers; Definition of monomers, polymers and polymerisation- Simple example of condensation and addition polymerisation reactions

Acrylic fibers; Synthesis of Acrylonitrile from propylene (Sohio process)- Solution polymerisation of acrylonitrile- Properties and uses.

MODULE-3: Nylon Fibers. **8 hrs**

Nylon fibers: Synthesis of caprolactum from aniline, adipic acid from cyclohexane and hexamethylene diamine from adiponitrile. Polycondensation reactions leading to the formation of Nylon 6 and Nylon 6,6. Properties and uses of Nylon fibers.

Module-4: Reaction of polyester fibers. **6 hrs**

Polyester fibers: Synthesis of Dimethyl tetraphthalate(DMT) from p-Xylene, tetraphthalic acid from benzoic acid and synthesis of ethylene glycol. Preparation properties and uses of polyester fibers.

SEMESTER 6

ANALYTICAL CHEMISTRY

Module 1: Overview of Instrumental analysis and Basic Chemistry- 12 hrs

Review What is analytical science, Quantitative and qualitative measurements- Interpretation of analytical results, Basic tools available-Concentration and various methods of expressing concentration and standard followed during chemical analysis-Variou online and offline sources available-Overview of Food and Drug Laws and Regulations-Regulatory affairs, Agencies for implementing regulation- Various regulatory protocols, USFDA, ICH Guidelines etc. WHO guidelines-The Central Drugs Standard Control Organisation (CDSCO)- International Organization for Standardization (ISO).

Module 2: Chromatography- 8 hrs

Theory and principles of chromatographic methods- Instrumentation and experimental procedures in-Thin layer and paper chromatography-Column chromatography-Gas chromatography (GC)-High performance liquid chromatography- Applications of various chromatographic techniques- Application in synthetic chemistry- Integrated chromatographic techniques- HPLC-MS.

Module 3: Spectroscopic techniques Atomic Absorption Spectroscopy (AAS) - 10 hrs

Principle, Instrumentation-Common analysis methods, internal standard and standard addition methods, Calibration etc. Infra red spectroscopy-(IR)- Introduction to Infrared spectroscopy, Theory of IR absorption, Instrumentation, Samples preparation methods-Thin-film analysis, Group frequencies, analysis and practical experimentation-NMR Spectroscopy- Theory of NMR -instrumentation-analysis of NMR spectra- UV-Vis absorption spectroscopy-Basic principles- Instrumentation-Sample analysis-Applications- Dye degradation monitoring using UV-Vis, Strengths and limitations of UV-Vis spectroscopy