

Madhabdev University

(A State University Established under the Assam Act. No. XXXV of 2017)



**Curriculum and Syllabus
Of
Multi-Disciplinary Courses (MDC)
&
Value Added Course (VAC)
For
Four Year Undergraduate Programme
In
Chemistry
From Academic Session
2026-2027**

Department of Chemistry

Narayanpur, P.O.: Dikrong (784164), Dist.: Lakhimpur, Assam

MDC-1: Chemistry in everyday life-I

Course Objectives: To introduce students to the chemistry of biologically important molecules and commonly used chemical products, including vitamins, drugs, fats and oils, soaps and detergents, with emphasis on their preparation, properties, uses, and significance in everyday life.

Course objectives: On completion of this course, the students will be able to:

CO1. Explain the classification, functions, sources, and importance of essential vitamins.

CO2. Describe the concept of drugs and pharmaceuticals, their therapeutic applications, and the uses of commonly prescribed drugs.

CO3. Understand the chemistry of fats and oils, including fatty acids, glycerides, hydrogenation, and the production of vanaspati and margarine.

CO4. Explain the preparation, composition, cleansing action, and applications of soaps and detergents.

CO5. Relate the role of these chemical substances to health, nutrition, hygiene, and their applications in everyday life

Unit I: Vitamins

Introduction to vitamins, classification (fat-soluble and water-soluble), sources, biological importance, and deficiency diseases. Study of the functions, sources, deficiency symptoms, and uses of Vitamin A, Vitamin D, Vitamin E, Vitamin K, Vitamin C, and Vitamin B₁₂.

(L-4, M-10)

Unit II: Drugs

Concept and necessity of drugs and pharmaceuticals; classification of drugs based on therapeutic action; mechanism of drug action (basic idea), therapeutic uses, common side effects, and precautions associated with aspirin, paracetamol, sulphadiazine, quinine, chloroquine, phenobarbital, and metronidazole.

(L-4, M-10)

Unit III: Fats and oils

Introduction to fats and oils; natural fats; edible and inedible oils of vegetable origin; common fatty acids and glycerides; physical and chemical properties of fats and oils; hydrogenation of unsaturated oils and its significance; manufacture and uses of vanaspati and margarine.

(L-6, M-10)

Unit-IV: Soaps and Detergents

Introduction to soaps and detergents; production of toilet and washing soaps; composition and cleansing action of soaps; enzyme-based detergents, detergent powders, and liquid soaps; advantages and limitations of soaps and detergents; applications in domestic and industrial cleaning.

(L-4, M-10)

Suggested books:

1. Singh, K. (2012). Chemistry in daily life (3rd ed.). PHI Learning.
2. Lassar-Cohn, Chemistry in Daily Life, Publisher, Read Books, 2007.
3. Gangopadhyay, P. K. Application Oriented Chemistry, Book Syndicate.

MDC-2: Chemistry in everyday life-II

Course Objectives: To provide students with an understanding of the chemistry of food additives, food processing and adulteration, artificial food colourants, pesticides, and fertilizers, and to develop awareness of their applications, benefits, safety, and environmental significance.

Course objectives: On completion of this course, the students will be able to:

- CO1. Explain the classification, functions, and applications of food additives, including preservatives, sweeteners, flavouring agents, and food colourants.
- CO2. Describe the principles of food processing, packaging, food adulteration, and methods for identifying common adulterants.
- CO3. Differentiate between permitted and non-permitted food colourants and evaluate their uses and potential health effects.
- CO4. Understand the classification, production, applications, and residual toxicity of common pesticides and the manufacture and uses of important fertilizers.
- CO5. Relate the role of food chemicals, pesticides, and fertilizers to food safety, public health, agriculture, and environmental sustainability.

Unit I: Food Additives

Food additives and their classification; role of food additives in improving quality, safety, stability, appearance, taste, and shelf life of food. Food flavours, food colours, food preservatives, artificial sweeteners, acidulants, alkalies, edible emulsifiers, edible foaming agents, and sequestrants; their functions, uses, and possible health concerns due to excessive use. Study of commonly used food preservatives such as benzoates, propionates, sorbates, and disulphites; artificial sweeteners including aspartame, saccharin, dulcin, sucralose, and sodium cyclamate; and food flavouring agents such as vanillin, alkyl esters (fruit flavours), and monosodium glutamate (MSG)

(L-6, M-10)

Unit II: Food Processing, Packaging and Adulteration

Basic concepts of food processing and packaging and their importance. Food adulteration: definition, types, causes, and significance; common adulterants in coffee, tea, milk, spices, grains, and food colours; difference between food adulteration and food contamination.

(L-4, M-10)

Unit III: Artificial Food Colorants

Basic concepts of food colourants; natural and synthetic colours, fake colours, and inorganic pigments; applications of food colourants and flavouring agents in the food industry; coal tar dyes, non-permitted colours, and metallic salts; utility of coal tar dyes in food and cosmetics and their harmful effects.

(L-4, M-10)

Unit-IV: Pesticides and Fertilizers

Introduction to pesticides and fertilizers; classification, production, applications, and residual toxicity of common pesticides including gammaxane, aldrin, parathion, malathion, DDT, paraquat, and deltamethrin. Types and importance of fertilizers; manufacture and uses of urea, ammonium nitrate, calcium ammonium nitrate, ammonium phosphates, polyphosphates, superphosphate, compound and mixed fertilizers, potassium chloride, and potassium sulphate.

(L-6, M-10)

Suggested books:

1. Singh, K. (2012). Chemistry in daily life (3rd ed.). PHI Learning.
2. Gayatri Baidya, Textbook of Food Chemistry, Book Rivers.
3. A Handbook of Agn. Food processing and marketing by S.C. Gaur, Agro Bios (India) 2012.

MDC-2: Chemistry in everyday life-III

Course Objectives: To provide students with an understanding of the chemistry of fuels, cosmetics, glass, ceramics, cement, dyes, pigments, paints, varnishes, and polymers, emphasizing their preparation, properties, applications, and environmental significance.

Course objectives: On completion of this course, the students will be able to:

C01. Explain the classification, production, properties, and applications of fuels and petroleum products.

C02. Describe the composition, functions, and industrial importance of cosmetics, perfumes, and essential oils.

C03. Understand the manufacture, properties, and applications of glass, ceramics, and cement.

C04. Explain the basic concepts of dyes, pigments, paints, varnishes, and important synthetic dyes, along with their industrial applications.

C05. Describe the classification, manufacture, properties, applications, and environmental aspects of polymers and polymeric materials.

Unit I: Fuels

Introduction to fuels and their classification; calorific (heating) value and its significance. Origin and carbonization of coal; coal gas, producer gas, water gas, and coal-based chemicals. Origin, composition, and refining of petroleum; cracking, knocking, octane number, and antiknock compounds. Properties and uses of kerosene, liquefied petroleum gas (LPG), and liquefied natural gas (LNG). Introduction to petrochemicals with C_1 – C_3 compounds and their applications.

(L-6, M-8)

Unit II: Cosmetics and Perfumes

Cosmetics and their classification; composition, functions, and applications of hair dyes, shampoos, suntan lotions, face powders, lipsticks, nail enamels, cold creams, vanishing creams, shaving creams, petroleum jelly, antiperspirants, and artificial flavours. Introduction to essential oils and their importance in the cosmetic industry with reference to eugenol, sandalwood oil, eucalyptus oil, rose oil, 2-phenylethyl alcohol, jasmone, civetone, and muscone.

(L-4, M-8)

Unit III: Glass and Ceramics

Introduction to glass and ceramics; definition, classification, and manufacture of glass; optical glass and colored glass. Clay and feldspar as ceramic raw materials; glazing and vitrification; manufacture, properties, and applications of glazed porcelain and enamel.

(L-4, M-5)

Unit-IV: Cement

Cement and its classification; composition and manufacture of Portland cement; setting and hardening of cement; composition, properties, and applications of white cement.

(L-3, M-5)

Unit V: Paints, Varnishes, Dyes and Pigments

Concept of paints and varnishes and their applications; basic concepts of dyes and pigments; natural and synthetic dyes; structure, properties, and applications of methyl orange, congo red, malachite green, and crystal violet.

(L-3, M-5)

Unit VI: Polymers

Introduction to polymers; classification and characteristics of polymers. Manufacture, properties, and applications of polythene, polystyrene, phenol-formaldehyde, and PVC. Natural rubber, synthetic rubber, silicone rubber, and synthetic fibres including nylon-66, polyester, terylene, and rayon. Role of foaming agents, plasticizers, and stabilizers in polymer industries. Applications of polymers in electronic devices, automobile components, medical devices, and aerospace materials. Environmental impact of polymers and strategies for the development of environmentally friendly polymers.

(L-6, M-9)

Suggested books:

1. Singh, K. (2012). Chemistry in daily life (3rd ed.). PHI Learning.
2. Barel, A.O.; Paye, M.; Maibach, H.I.(2014), Handbook of Cosmetic Science and Technology, CRC Press.
3. Gopalan, R. Venkappayya, D.; Nagarajan, S. (2004), Engineering Chemistry, Vikas Publications.
4. Ghosh, P. (2001), Polymer Science & Technology, Tata Mcgraw-Hill.

Value Added Course

NCrF level	4.5
Title of the Course	IKS and Chemistry
Course code	CHMV-201
Paper credit	02 (L 2 – T 0 - P 0)
Total Contact Hours	30 Hours
Distribution of Marks	Theory 50 (Theory End semester 35+ In-semester 15)

Course Objectives

- To provide ancient Indian knowledge on atoms, matter, metallurgy and nuclear chemistry.
- To understand the ancient Indian knowledge about organic chemistry
- To get ancient knowledge on thermodynamics, kinetics and quantum.
- To impart knowledge of ancient concept on food preservation and extraction method.
- To get ancient knowledge on **Vitamins, Herbs and Beverages**
- To impart knowledge of ancient concepts on Environmental Chemistry, Analytical and Industrial Chemistry.

Course Outcomes (COs)

After successful completion of the course, students will be able to:

CO1: Understand ancient Indian concepts related to atomic theory, chemical bonding, metals and metallurgy, and nuclear chemistry

CO2: Understand ancient Indian concepts of organic chemistry and related areas

CO3: Get ancient concept on food preservation and extraction method.

CO4: Get the ancient Indian knowledge **on physical chemistry background.**

CO5: Understand the **Concept of IKS on Vitamins, Herbs and Beverages**

CO6: **Get the** Concept of IKS on Environmental Chemistry, Analytical and Industrial Chemistry

Unit I Atoms, chemical bonding, metals and metallurgy and nuclear chemistry 5 hours

Introduced the concept of “Paramāṇu” (atom), Matter (dravya), dvyaṇukas (diatomic molecules) and triyaṇukas (triatomic molecules), Atomic Theory (Vaisheshika)

Kaṇāda theory of bonding (saṃyoga) and separation (vibhāga) — analogous to formation and breaking of chemical bonds

Rasashastra (Alchemy and Metallurgy) - Methods of metal purification (Shodhana) and calcination (Marana), bhasmas (metallic medicines). Metallurgical heritage: Wootz steel, zinc smelting at Zawar, copper and bronze technology, corrosion resistance in Indian iron pillars

Nuclear chemistry (Rasayana and Alchemy)

Unit II: Organic Chemistry and related areas 5 hours

Ancient organic chemistry and its development (from ancient to modern era). Importance of Organic Chemistry & organic systems to human beings & society. Some Known organic compounds present in nature in historic and pre-historic India.

Applications of Aromatic Compounds in IKS- Rituals (Yajna)

Early theories on origin of petroleum. Hydrocarbon as a source of heat and energy.

Unit III: Perfume and food additives, adulterants and contaminants

5 hours

Ancient Indian Concepts Related to Perfumery (Gandha Shastra), food additives, adulterants, and contaminants- The concept of vikāra (change, corruption) or aparādravya, (nonsubstances/adulterations) in certain classical texts can be analogised to adulterants/contaminants.

Unit IV: Thermodynamics, Kinetics and Quantum

5 hours

IKS on Thermodynamics- Panchabhuta Theory- Prithvi (Earth), Ap (Water), Agni/Tejas (Fire), Vayu (Air), Akasha (Space), interaction of these elements, especially Agni (heat/energy) with Prithvi (solid substances). Spontaneity and Reaction Propensity “Samsargaja” reactions: happen spontaneously under natural conditions, “Siddha” reactions: require specific treatment.

Second Law and Entropy: Sāmkhya philosophy’s concept of dynamic balance among Gunas (Sattva, Rajas, Tamas) as a natural move toward equilibrium. Gibbs Free Energy: The Ayurvedic notion of Ojas as usable energy or vitality within a system.

IKS on Chemical Kinetics-Anupana theory (vehicle of action in Ayurveda)

IKS on quantum chemistry Vaisheshika Sutras, Upanishadic & Sankhya thought on discrete elements (tattvas) and subtle energies

Unit V: Concept of IKS on Vitamins, Herbs and Beverages

5 hours

IKS on Vitamins- Dietary Principles (Ahara), balanced diet (Sattvic Ahara), Rasa (taste), Guna (quality), Virya (potency), Vipaka (post-digestive effect), Specific Herbs and Minerals.

Acidic and basic herbs- Sour (acidic) herbs → stimulate digestion (Pitta), Bitter / alkaline herbs → detoxification (Kapha) Traditionally known alcoholic beverage such as sugarcane juice other fruit juice or fermented fruit juice during historic and pre historic India. Some known acidic fruit juices mentioned in ancient literature.

Representation of vectors, addition and subtraction of vectors, scalar and vector products, Cartesian, polar and three-dimensional coordinate systems, applications in chemistry

Unit VI: Environmental Chemistry, Analytical and Industrial Chemistry

5 hours

Concepts like “Bhoomi Mata” (Earth as Mother) and “Jala Deva” (Water as Divine)

Philosophical Basis on renewable energy- Vedic concept of “Prakriti” (nature) and “Sthira” (balance), Renewable energy concepts align with Ahimsa (non-destructive use)

IKS on Chromatography-The process of “Bhavana” (tritulating herbs with liquids repeatedly), Different solvents (water, oil, alcohol, ghee) extracted different types of phytochemicals, much like solvent polarity in chromatography.

Philosophical & Empirical Basis on ceramics- Pottery (Kumbhakarana / Kumbhika), Silpasastra, Evidence is found in archaeological sites (Harappan Civilization, Mohenjo-Daro, Taxila)

END of the Syllabus